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# Chronology of KSC and KSC Related Events for 1979

National Aeronautics and  
Space Administration

**John F. Kennedy Space Center**



CHRONOLOGY OF  
KSC AND KSC RELATED  
EVENTS FOR  
1979  
SELECTED AND EDITED BY  
FRANK E. JARRETT, HISTORIAN

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January 1979

**January 4:** The first Spacelab instrument pallet has been delivered to Kennedy Space Center by ERNO of West Germany, prime contractor for Spacelab for the European Space Agency (ESA). A second pallet is to arrive at KSC by ship soon.

Built by British Aerospace Dynamics Group, the two instrument pallets, which form part of the Spacelab engineering model, will be used during orbital test flights of the Space Shuttle in 1980. They will collect data prior to the first operational flight of the complete Spacelab--made up of a long pressurized module and one instrument pallet--in mid-1981.

The pallets, which are 2.87 (9.4 ft) meters long and 4.46 meters (14.6 ft) in diameter and weigh 650 kilograms (1,433 lbs), are practically identical in design to the operational flight units.

Installation of experiments and test equipment on the two pallets is slated to begin next month. (Defense/Space Business Daily, Vol. 102, No. 2, Thursday, January 4, 1979, p 13)

- o The Northrup Strip at White Sands, New Mexico, a Space Shuttle orbiter auxiliary landing site, was the subject of an investigation conducted December 11-14th, 1978, by KSC's Design Engineering personnel to verify conditions for erection of the Mate/Demate Stiffleg Derick. Site investigations revealed soil conditions that are not as favorable as expected. Facilities such as power and water are available in some select locations. The landing strip is approximately 40 miles from Las Cruces, New Mexico.

Meetings with NASA/JSC White Sands Test Facility personnel and Army Facilities engineering personnel were conducted to obtain soils information and general support information. KSC's mission and plans were reviewed and the Stiffleg Derick operations and design were presented to the White Sands Test Facility and Army personnel. A tentative site known as "Cherry Site," southeast of the existing strip, has been selected for the Derick facility. Adequate power is available at this site.

Based on what was observed in the Northrup Strip area, security regulations, distance from living accommodations, and other support facilities, the cost of construction will be higher than originally estimated. Design analysis of soils and method of construction, which should be determined by the 30% level of design, will be a good indicator of the construction cost increases. (Notes [to Center Director] by Raymond Clark, 1-4-79)

**January 5:** NASA's Voyager 1 has begun a three-month period of systematic observation of the planet Jupiter and its major moons.

The spacecraft is now close enough to Jupiter (60 million kilometers, or 37 million miles) that its two cameras will be taking photographs better than those taken from Earth.

Voyager 1 will study Jupiter and five of its satellites at close range, making measurements and taking more than 15,000 pictures during the three-month period. Eleven comprehensive scientific investigations will be performed as scientists probe the largest planet in the solar system and its more important satellites.

On January 4, 1979, Voyager 1 was 598 million km (373 million mi.) from Earth, 16 months after its launch.

Closest approach to the planet, as Voyager 1 flies past, will occur early on the morning of March 5, 1979. After flying past Jupiter and also studying the satellites Io, Europa, Ganymede, Callisto and Amalthea, Voyager 1 will begin a 20-month cruise toward the ringed planet Saturn.

Voyager 1 was launched Sept. 5, 1977, more than two weeks after its companion Voyager 2. Voyager 1 flew a faster trajectory and is now almost four months ahead of Voyager 2, which is scheduled to make its closest approach on July 9.

The Voyager project is managed by the Jet Propulsion Laboratory, a government-owned facility in Pasadena, Calif., operated for NASA by the California Institute of Technology. (NASA News, Headquarters, Washington, D.C., Release No. 79-2, January 5, 1979)

**January 8:** More than 1.2 million visitors took the guided bus tours of the Kennedy Space Center and historical Cape Canaveral Air Force Station in 1978 as the Visitors Center experienced the second busiest year in its 13-year history.

Total tour attendance reached 1,289,653 in 1978, a 15.4 percent increase over last year's final tally of 1,117,603 patrons. Bus tour patronage for 1978 exceeded all previous years with the exception of the 1,389,000 in 1972 at the close of the Apollo lunar landing program.

For December, traditionally the Visitors Center's busiest month, bus tour patrons reached 89,355, a drop of 11.5 percent below the 100,983 for the same month in 1977. TWA Services, which operates the tour and Visitors Center for NASA, attributed the decline to visitation figures lower than anticipated for the entire state.

However, with the exception of December, monthly tour patronage figures for 1978 surpassed the previous year's monthly totals as the Spaceport continues to prepare for the first manned orbital test flight of the Space Shuttle, scheduled for this September. (NASA News Release No. KSC 3-79, January 9, 1979)

**January 11:** Curtailment in energy consumption from 4:00 p.m. December 22, 1978, through 8:00 a.m. January 2, 1979, resulted in a savings of 1,035,000 KWH and 22,100 gallons of fuel oil, which amounted to \$40,500 at current rates. Overall energy savings were  $15.7 \times 10^9$  BTU. Savings were less than anticipated due to more than 1,600 Civil Service and contractor personnel working during this holiday season. (Notes [to Center Director] from P.A. Minderman, 11-11-79)

- o The decision to possibly have Rockwell International personnel at KSC install TPS tiles on the Orbiter after it arrives at KSC has resulted in a special effort to get sufficient numbers of RI personnel trained and certified to perform the tasks. To meet the requirements a certified instructor has been brought to KSC and the first of several 40 hour classes started today. Twelve (12) technicians will be trained and certified in each class. (Notes [to Center Director] from W. Kapryan, 1-11-79)

**January 19:** NASA today accepted with appreciation the final report of the board convened to investigate the power failure on the Seasat spacecraft on Oct. 9, 1978, after 105 days of satisfactory operation. The board has now been formally discharged.

The board's report identifies the source of the failure as an electrical short in the slip ring assembly of the solar array, possibly triggered by wire-to-brush assembly contact, brush-to-brush contact, or contamination. (NASA News, Headquarters, Washington, D.C. Release No. 79-9, January 19, 1979)

- o The Director, KSC, announced a reorganization of the Space Transportation Systems Project Office, headed by Robert H. Gray, and the Space Vehicle Operations Directorate, headed by Walter J. Kapryan. According to the announcement, the purpose of the reorganization was to reduce the varied functions of the organizations to allow Gray and Kapryan to concentrate more time on the near term problems, without being encumbered by payloads planning. The organizational changes created three new offices at the Directorate level, and essentially abolished the Space Vehicle Launch Operations Directorate.

The Cargo Projects Office, managed by Mr. John J. Neilon, will be responsible for project management for Shuttle payloads. This will include the European-built Spacelab, the upper stages which will be used to boost payloads beyond the Shuttle's orbital altitude, and automated payloads similar to communications, weather, and scientific satellites now being launched on expendable vehicles.

The Cargo Operations Directorate, directed by Mr. George F. Page, will be responsible for the Center's test and checkout of new payloads. This directorate will also be responsible for postlanding processing of those payloads which are returned from space. The remaining expendable vehicle launches, which include seven in 1979, will be carried out by the Cargo Operations Directorate.

The Advanced Planning and Technology Office, managed by Mr. Andrew J. Pickett, will be responsible for planning the future management concepts and organizational structure for the Center, and defining the transition process between the Shuttle development flights and the Shuttle operations era. This office will also do long range planning for future programs and will be in charge of technology utilization, the program designed to feed NASA developed technology into commercial applications. (John F. Kennedy Space Center, NASA Announcement; subject, KSC Organizational Changes, January 19, 1979)

**January 25:** The new orbiter names were disclosed by NASA Administrator Dr. Robert Frosch in Congressional testimony on January 25.

Historical and illustrious ships used in exploring the world's seas have been selected as the namesakes of four Space Shuttle orbiters to be flown into space.

Orbiter 102, scheduled for delivery to KSC in March and to be launched in November of this year, has been designated Columbia. The original Columbia was a sloop operating out of Boston which entered and explored the mouth of the Columbia River in 1792.

The second orbiter scheduled for space flight has exchanged its prosaic designation of 099 for the name Challenger. The original Challenger was an American vessel which made a prolonged cruise from December, 1872, to May 1876, gathering data about the Atlantic and Pacific Oceans. This cruise gathered sufficient data to fill 50 volumes.

Orbiter 103 has been named Discovery. The original Discovery was a British vessel used to explore Canada's Hudson Bay and search for a Northwest Passage from the North Atlantic to the Pacific in 1611.

Orbiter 104 has been named Atlantis after the first American vessel designed especially for oceanic research. This two-masted ketch logged half a million miles of scientific cruising between 1930 and 1966. (Spaceport News, "Orbiters to be Named for Sailing Vessels," Vol. 18, No. 3, John F. Kennedy Space Center, February 2, 1979, p 1 and 3)

- o A prospectus soliciting proposals to manage and operate the public visitation program at the Kennedy Space Center in Florida was released by NASA on January 25.

The successful proposer will be required to make a substantial initial investment, beginning with a fleet of buses to transport visitors along a tour route which includes historical landmarks and operational launch facilities for the Space Shuttle and conventional rockets.

The proposals are also to include offers for financing new buildings and facilities to enhance the NASA visitors program. NASA will provide some facilities, property and services for the concessioner's use but the visitors program must otherwise be financially self-supporting.

The concessioner is to be granted the right to conduct such revenue producing activities as the sale of food, souvenirs and bus tour tickets, but is also required to provide some nonrevenue creating services in support of the program and to pay the expenses of the concession.

The solicitations have been mailed to about 50 companies involved in tourism, recreation, park management and related fields. (NASA News Release No. KSC 12-79, January 26, 1979)

- o As of January 25, Rockwell International Corporation had approximately 10,000 tiles left to install on the orbiter. Another 300 - 400 damaged tiles that are installed now will have to be replaced after the orbiter arrives at KSC in March. Very few of the 6000 gap fillers and thermal seals have been installed. Most of these will be installed at KSC. (Notes [to Center Director] from Walter Kapryan, 2-1-79)
- o On Jan. 25, the Skylab space station was maneuvered into an attitude that may allow some small measure of control over the vehicle's reentry into Earth's atmosphere. Since June 1978, engineers at the Marshall Space Flight Center and controllers at the Johnson Space Center have been maintaining Skylab in an attitude of least atmospheric drag, attempting to keep it in space until a reboost or deorbit attempt could be made by the Space Shuttle.

When NASA decided in December to abandon that attempt, engineers began looking at the vehicle in a different way. The new solar inertial attitude positions the solar panels to constantly point toward the Sun, assuring full electrical power at all times and thus preserving the possibility of some minimal influence at final reentry.

Views differ as to the feasibility of useful control over the spacecraft's final reentry, but it was deemed desirable to preserve the option while studies continued. (NASA Activities, Vol. 10, No. 3, March 1979, p 13)

**January 30:** The USAF/SAMSO Spacecraft Charging at High Altitudes (SCATHA) satellite was launched into a synchronous transfer orbit from the Eastern Test Range at 4:42 p.m. EST, on January 30, 1979, by a Delta 2914, Vehicle, Mission Number 148.

Performance of the Delta launch vehicle was nominal and placed the spacecraft and its apogee boost motor (ABM) into the desired transfer orbit. The orbital elements achieved, compared with the nominal expected, are as follows:

	Expected		Measured	
	Kilometers	Miles	Kilometers	Miles
Apogee	43,447	26,997	43,266	26,884
Perigee	185.1	115	185.1	115
Inclination (degrees)	27.4		27.39	



The satellite performed satisfactorily during the transfer orbit and the ABM was fired successfully at 4:40 p.m. EST, on February 2, 1979. The satellite was then established in its operational mode, which is a controlled drifting eastward at a rate of 5 deg/day as planned.

The SCATHA Program (for Spacecraft Charging at High Altitude) (Program P78-2) was established by USAF to seek means to prevent anomalous behavior associated with satellites orbiting the Earth at or near synchronous altitudes of 36,000 km (22,000 statute miles).

Satellites thus far have experienced unexplainable jumps in electrical potential and have been subjected to voltage increases from a nominal one to two volts to a dangerously high 15,000 volts over a 5-minute period.

This type of electrical charging (and subsequent discharging) has resulted in some satellites performing unexpected operations - including spinning of previously despun communications antennas and false recordings of unachieved events.

Specifically, the satellite includes more than a dozen experiments which will measure electrons, protons, and alpha particles, the surface charging and discharging of the satellite, as well as anomalous currents flowing through the spacecraft's wires at any given time.

In addition to orbiting delicate scientific equipment to measure and identify the source of spacecraft charging, the SCATHA satellite will also carry sample materials of metals and insulation devices both uncommon and unique to previously orbited synchronous satellites. These materials will be subjected to electrical impulses by either the natural space environment or by artificial means through the use of the electron or ion beam system. (Prelaunch Mission Operations Report No. M-492-303-79-01, subj. Spacecraft Charging at High Altitudes (SCATHA) - Delta Launch, January 17, 1979, p. 3. Also, Post Launch Mission Operations Report No. M-492-303-79-01, subj. USAF/SCATHA Mission Post Launch Report, October 25, 1979)

- o The following budget estimates from the White House reflect the declining runout costs of NASA's Space Research & Technology programs by FY '82 that were referred to by NASA Administrator Frosch when he said the agency could have \$690 million available for new starts in FY '81-82.

Space Research & Technology  
(in millions of dollars)

Budget Authority	FY '78	FY '79E	FY '80E	FY '81E	FY '82E
Space Flight	\$2,192	\$2,424	\$2,332	\$2,110	\$1,825
Science, Application, Tech.	1,065	1,227	1,404	1,467	1,490
Supporting Activities	369	384	435	515	498
Total:	<u>\$3,626</u>	<u>\$4,035</u>	<u>\$4,168</u>	<u>\$4,092</u>	<u>\$3,813</u>

Outlays	FY '78	FY '79E	FY '80E	FY '81E	FY '82E
Space Flight	\$2,260	\$2,371	\$2,339	\$2,125	\$1,868
Science, Application, Tech.	972	1,170	1,310	1,448	1,517
Supporting Activities	354	387	407	495	518
Total:	<u>\$3,586</u>	<u>\$3,928</u>	<u>\$4,056</u>	<u>\$4,068</u>	<u>\$3,903</u>

Under these budgets:

--Outlays for development and production of the Space Shuttle are expected to total \$1.6 billion in FY '80, dropping to \$700 million in FY '82.

--Outlays for space science and exploration are estimated at \$672 million in FY '80 and are expected to increase to \$778 million in FY '82.

--Outlays for development and demonstration of applications of space technology are expected to total \$420 million in FY '80, increasing to \$505 million in FY '82.

(Defense/Space Business Daily, Vol. 102, No. 20, Tuesday, January 30, 1979, p 153)

**January 31:** The Carter Administration is making a mistake by cutting the number of Space Shuttle orbiters from five to four, former NASA Administrator Dr. James C. Fletcher told the Senate Space Subcommittee Wednesday.

He said, in fact, that he had always believed that a fleet of five orbiters "was marginal to begin with," noting that the late chairman of the Joint Chiefs, Gen. George Brown, has strongly recommended that seven orbiters be built in order to accommodate the new military missions that would be developed. Fletcher added that new missions will also be discovered for the civilian program as well.

He said he hoped the four orbiter fleet adopted by the Administration would not foreclose the option of carrying out these still-to-be-determined additional missions. (Defense/Space Business Daily, Vol. 102, No. 23, Friday, February 2, 1979, p 171-2)

- o Twenty-one NASA and contractor employees were recently honored at a "Silver Snoopy Award" ceremony, the first of the coveted awards given since the Apollo-Soyuz Test Project in 1975.

The Silver Snoopy is not an official award of the Agency, but a memento personally given by the astronauts in appreciation of an individual's superior work. Each honoree received the Snoopy pin, along with a letter from astronaut John Young commending his or her contributions to crew safety and successful space missions.

"Snoopy," the impish pooch created by cartoonist Charles Schulz, has symbolized craftsmanship and the "watchdog of quality" since early in the Apollo program.

NASA personnel receiving the astronauts' award were: Joel Blum, VO; Tom Cain, TO; Walt Covington, AD; John Fairey, TI; Bette Hudecek, VO; Ric Hurt, DE; Gary Ray, DE; Marshall "Scotty" Scott, DE; Dave Steele, VO; and John Wood, TO.

Five employees with Planning Research Corp. were presented with Silver Snoopys: Bill Angerer, Anne Buchanan, David McKissick, Charles Parker, and Kenneth Rosser (PRC/Chrysler).

The other outstanding space workers honored were: Herman Brooks, Management Services, Inc.; Joel Carter, Defense Contract Administration Services, Miami; Peter Gannon, Martin Marietta Corp.; Royce Hall, Computer Sciences Corp.; Guy Pace, Expedient Services; and Pat Patterson, Wackenhut. (Spaceport News, Vol. 18, No. 4, John F. Kennedy Space Center, February 16, 1979, p 2)

- o Tom Utsman has been appointed Director of Operations Management in the Technical Support Directorate. He fills the position vacated by Robert Gorman, who retired from federal service January 12.

Previously, Utsman served as associate director in Design Engineering. In his new position, he will be responsible for the operational integration support efforts within Technical Support. This includes site activation, test support, operations planning, logistics, reliability and quality assurance, configuration management, and personnel and administrative functions. In addition, Utsman's directorate serves as the KSC interface with ETR for flight safety and the reimbursement program.

A native of Dearborn, Michigan, Utsman earned a B.S. degree in Mechanical Engineering from the University of Michigan and an M.S. degree in management from Florida State University. He has worked for Shell Oil Company, General Dynamics/Astronautics and the Brown Engineering Company.

Utsman joined KSC in 1963. In addition to serving as Associate Director, Design Engineering, he held the titles of Deputy Director, Project Management; Technical Assistant to the Associate Director for Facilities and Systems Management; and Chief, Shuttle Project Engineering Office.

Utsman's outside interests include Little League sports, where he umpires baseball and coaches football. He also serves on the Cocoa Beach City Planning Board. (Spaceport News, Vol. 18, No. 4, John F. Kennedy Space Center, February 16, 1979, p 3)

- o In preparation for future Space Shuttle activities at Vandenberg Air Force Base in California, a seven-member team of Air Force personnel has been working at KSC since last summer.

Located in the VAB, LCC and Pad A areas, the team has been gaining experience working with launch and landing procedures for the Shuttle. At the conclusion of the two-year assignment, the group will be transferred to the West Coast, where they will form the nucleus of the Air Force Space Shuttle launch and landing team.

The team, led by Major George Stetz, includes Captain Eric P. Lloyd, 2nd Lt. Dale G. Wilson, Chief Master Sergeant Paul E. Whitlock, Technical Sergeant Christopher Z. Love, Technical Sergeant Chester A. Cooper, and Staff Sergeant Clarence W. Ranow. The men represent over 38 years of Air Force space launch experience with the Titan III, Atlas and Thor vehicles. They are working here under a joint NASA/AF agreement between KSC and the Space and Missile Test Center's 6595th Aerospace Test Wing at Vandenberg. (Spaceport News, Vol. 18, No. 4, John F. Kennedy Space Center, February 16, 1979, p 4)

During January: NASA's first High Energy Astronomy Observatory (HEAO 1) exhausted its supply of attitude control gas in January, ending a 17-month mission to survey and map X-ray sources throughout the sky. Although HEAO 1 was designed for only a six-month lifetime (the length of time required to survey the entire sky), the quality of data returned was so excellent that extensions subsequently were authorized.

The spacecraft was the first of a three-mission program to study pulsars, quasars, exploding galaxies and black holes in space. The second observatory, HEAO 2, was launched Nov. 13, 1978, and the third one is scheduled for launch this coming September. The HEAO project is managed by NASA's Marshall Space Flight Center.

Since successfully completing its primary mission in February 1978, HEAO 1 has continued to sweep the skies, reaping a rich scientific harvest of detailed X-ray data of unprecedented accuracy, NASA scientists reported. All experiments have continued to function during the extended mission and spacecraft systems have fully supported all scientific operations. Besides mapping the X-ray sky, the satellite has pointed at and studied more than 300 stellar sources of particular interest. It also has measured low-energy gamma-ray flux.

Although analysis of HEAO 1 data will require years of work by the astrophysicists who study high-energy phenomena, more than 160 technical papers and scientific presentations already have been given on HEAO 1 results. Scientists believe that this important new knowledge may bring fundamental changes in concepts of the universe. (NASA Activities, Vol. 10, No. 3, March 1979, p 13)

- o Over the last two decades, the U.S. has spent about \$100 billion on its space program, Presidential Science Adviser Dr. Frank Press said last week.

This expenditure includes \$67 billion for civil programs, of which over \$25 billion was for Project Apollo, and \$33 billion for military programs.

"We now spend as much annually on military programs as we do for civil programs," he said. The NASA and DOD budgets for space total \$7.9 billion in FY '80, an increase of 12 percent over FY '79.

In addition, the private sector is making a major investment in space--over \$2 billion in communications satellites alone. (Defense/Space Business Daily, Vol. 102, No. 19, Monday, January 29, 1979, p 143)

- o The first orbital test flight of the European Space Agency's Ariane launch vehicle, which Europe considers to be an alternative to the U.S. Space Shuttle, has been delayed from June to November of this year due to an explosion of the vehicle's third stage propulsion system in a ground test Nov. 28.

The rescheduling has been made despite the fact that the French Space Agency (CNES), which investigated the accident, concluded that it was caused by a malfunction of a safety device on the ground, which "does not call the stage design in question."

Despite the five month delay in the initial flight test, ESA has maintained the operational date for its launcher: December 1980.

This, it said, leaves a margin of four months before the first planned user launch of Ariane--the Agency's Exosat satellites, which is scheduled for launch in April 1981.

The revised schedule for the four Ariane development flights, all but the first of which will carry satellites, is as follows:

Launch No.	New Schedule	Original Schedule
L01	Early November 1979	June 1979
L02	Early March 1980	December 1979
L03	June 1980	May 1980
L04	October 1980	October 1980

A capability to provide four operational Ariane flights per year is planned beginning in 1981. ESA has estimated a need for as many as 68 and as few as 17 Ariane launches in the 1981-1990 period.

The Ariane program got a big boost last month at the expense of the Space Shuttle when Intelsat decided to use the expendable vehicle to launch one of its Intelsat V satellite in 1981 or 1982. (Defense/Space Business Daily, Vol. 102, No. 14, Monday, January 22, 1979, p 93)

- o A NASA review board has blamed the failure of the \$95 million Seasat spacecraft on inadequate design analysis of the spacecraft before and after it was built by its prime contractor, Lockheed Missiles & Space Co., and the NASA manager of the project, the Jet Propulsion Laboratory.

The failure of the spacecraft on Oct. 9, after 105 days of operation, resulted from a loss of electrical power in the Agena bus that was part of the spacecraft. The power loss was caused by a "massive and progressive short" in one of the slip ring assemblies that was used to connect the rotating solar arrays into the power subsystem. The Board believes that the short was caused by an electrical arc between adjacent slip ring brush assemblies, triggered by wire-to-brush or brush-to-brush contact, or by a contaminant that bridged two components.

The Board said that the way the slip ring assembly was wired [with most of the adjacent brush units being of opposite polarity] along with the congested design itself made the assembly "a unique, first-of-a-kind component that was particularly prone to shorting." (Defense/Space Business Daily, Vol. 102, No. 17, Thursday, January 25, 1979, p 122)

February 1979

**February 1:** NASA's John F. Kennedy Space Center has awarded a \$457,717 contract to City Roofing Company Inc., Memphis, Tennessee, to replace the roof on the massive Vehicle Assembly Building.

Under the nearly half million dollar contract, City Roofing Company will furnish all labor, materials, equipment and services necessary for rehabilitation of the VAB roof. The work will consist of demolishing existing roof sections, and building up sections with new felt, light-weight concrete and vinyl. Repairs will be made to blistered areas, and the entire roof area, some 32,276 square meters (348,500 square feet), will be re-covered with a new vinyl topcoat.

Putting a new roof on the VAB is approximately equivalent to re-roofing 174 average-sized houses. Covering a ground area of 3.2 hectares (eight acres) and with a volume of nearly 3.67 million cubic meters (129.5 million cubic feet), the VAB is large enough to house 3 3/4 Empire State Buildings.

Work under the fixed-price contract, one set aside for a small business firm in a labor surplus area, is to be completed in 120 days. (NASA News Release, No. KSC 14-79, February 1, 1979)

**February 5:** The National Aeronautics and Space Administration has signed a contract with Rockwell International Corp., Space Systems Group, Downey, Calif., for the manufacture of two Space Shuttle orbiters (OV-103 "Discovery" and OV-104 "The Atlantis"), conversion of a ground-test orbiter (OV-099 "Challenger"), and modification of the first flight orbiter (OV-102 "Columbia").

Completion of the work will provide NASA with four orbiters for Space Shuttle operations.

Under terms of the \$1.9 billion cost-plus-award fee contract, Rockwell will perform the work at its Downey and Palmdale, Calif. facilities and at the NASA Kennedy Space Center, Fla. The NASA Johnson Space Center, Houston, Texas, will administer the contract.



- o Rockwell's work on the contract, which runs to October 1983, will be carried out at its facilities in Downey and Palmdale, Calif., and at NASA's Kennedy Space Center.

The contract includes a stipulation placing it under the Administration's wage-and-price guidelines.

OV-99 "Challenger" is scheduled for delivery in September 1981; OV-103 "Discovery" in December 1982, and OV-104 "Atlantis" in December 1983. (NASA News, Headquarters, Washington, D.C., Release No. 79-15, February 5, 1979) also (Defense/Space Business Daily, Vol. 102, No. 25, Tuesday, February 6, 1979, p 186)

**February 6:** NASA has essentially filled the Space Shuttle manifest for the first two years of Shuttle operations, NASA Administrator Dr. Robert Frosch told the House Science & Technology Committee Tuesday.

The following is the planned launch schedule and payload for the Space Shuttle up to early 1983.

Flight	Date	Payload
1	11/09/79	Development Flight Instrumentation (DFI) only.
2	03/06/80	OSTA Pallet (Earth viewing), DFI.
3	06/05/80	PDRS Test Article, DFI.
4	08/26/80	GOES-D, DFI.
5	10/28/80	SSCP Test, USS Pallet (physics and astronomy), DIF.
6	12/10/80	Contingency (open), DFI.
7	02/27/81	TDRS-A.
8	03/26/81	GOES-E, SBS-A, ANIK-C-1, SPAS-01.
9	04/23/81	Intelsat-F, INSAT-1A, Pallet, Opportunity.
10	05/29/81	TDRS-B.
11	07/01/81	Intelsat-G, SBS-B, Syncom IV-1.
12	08/12/81	Spacelab 1.
13	09/17/81	TDRS-C, ANIK C-2.
14	10/16/81	LDEF, SMM retrieval, OMS Kit.
15	11/17/81	STP P-80-1, DOD 81-1.
16	01/06/82	Gallileo Jupiter Orbiter Probe.
17	01/22/82	Spacelab 2 (with cosmic ray experiment).
18	02/24/82	Zohren-1, GOES-F, SBS-C.
19	03/10/82	TDRS-D, ANIK D-1.
20	04/07/82	DOD 82-1.
21	04/23/82	Spacelab 3.
22	05/13/82	Reflight Opportunity.
23	06/02/82	Zohren-2, Material Science Pallet, Syncom IV-2.
24	06/22/82	SSUS-A Opportunity, INSAT-1B, Palapa B-1.

Flight	Date	Payload
25	07/09/82	AMPTE-A, ANIK-C, Pallet Opportunity (2).
26	07/28/82	LDEF retrieval, SSUS-D Opportunity.
27	08/17/82	Spacelab (Life Sciences-1).
28	09/02/82	DOD 82-2.
29	09/30/82	Spacelab (Physics Astronomy-1).
30	10/20/82	Palapa-B-2, RCA-D, Syncom IV-3.
31	11/10/82	Spacelab Opportunity.
32	12/02/82	AMPTE-B, SSUS-D Opportunity, SSUS-A Opportunity.
33	01/05/83	Spacelab (OMFT-1).
34	01/25/83	DOD 83-1.

Defense/Space Business Daily, Vol. 102, No. 28, Friday, February 9, 1979, p 209-10)

**February 8:** Rockwell International Space Division (RI/SD) presented a plan for waterproofing Thermal Protection System tiles, gap fillers and thermal blankets after each flight. This waterproofing is necessary, according to RI/SD, because the waterproof coating on these materials is lost due to high entry temperatures experienced. The waterproofing would be done at Dryden Flight Research Center for STS-1 through STS-4, and at KSC for subsequent missions (probably when the orbiter is between the OPF and VAB). This task will most likely significantly impact Dryden and KSC flows.

RI/SD proposed using special access stands, new ground support equipment (GSE) such as pumps, drums, brushes, spray wands, etc., to accomplish this task. The waterproof substance would be a "Scotch Guard - 3M" product which requires a ventilated work area. RI/SD also stated that the orbiter nose cap and some leading edge wing panels would have to be removed every flight in order to waterproof the thermal barrier material. Finally, RI/SD stated that if the orbiter was wet (e.g., after landing in a rainstorm) that the waterproofing scheme would not work until the Orbiter dried out.

Both the JSC Technical Status Review Board and KSC found this plan to be unacceptable because several practical questions were left unanswered by RI/SD. (Notes [to Center Director] from Robert H. Gray, 2-6-79)

- o A meeting was held in Washington on February 8 to review the status of the Teleoperator Retrieval System Program. Martin Marietta presented the results of the trade studies directed by Headquarters. Basically Martin reported that \$21M were recoverable of the \$24M expended to date. These numbers assume restart within two months and that Martin would be the contractor.

In general the meeting was not structured to provide any real insight regarding "where we go from here." The only positive position presented by Headquarters was that a Teleoperator is required, but when and how were not addressed.

It was obvious that until the options are presented to Mr. Yardley, no real direction can be expected. Unofficially, Headquarters requested POP 79-1 input be submitted for Teleoperator instructions based upon best available estimates. (Notes [to Center Director] from Robert H. Gray, 2-15-79)

**February 9:** Guided bus tours of NASA's John F. Kennedy Space Center attracted 87,661 visitors in January, a 10.1 percent jump over the 79,602 recorded for the same month a year ago.

The increase maintains a trend established last year when the Visitors Center recorded its second busiest year. Bus tour patronage has steadily increased over the past 13 months as the nation's spaceport continues its preparations for the first manned orbital flight of the Space Shuttle, scheduled for November. (NASA News Release No. KSC 15-79, February 9, 1979)

**February 14:** The Payload Canister Transporter arrived at Port Canaveral on February 14, 1979, aboard the SS Hannover. During transit to Port Canaveral, the ship encountered a storm with over 35-foot waves. The transporter, which was deck cargo, was submerged under the waves during the storm. After arrival at Port Canaveral, an effort was made to start the transporter on board the ship but it would not start. The transporter was loaded on the KSC barge and shipped to KSC. After arrival at KSC, the transporter was started and moved to the OPF under its own power. Damage in route will result in about a 15-week delay for repairs. The cab and its controls will be returned to Germany. Work is expected to be completed by the end of May. The fabrication contractor, KAMAG, will repair the damage that was done during shipment. (Notes [to Center Director] from Raymond L. Clark, 2-22-79)

**February 15:** NASA believes it will cost \$200 to \$300 million to provide a thrust augmentation system - consisting of single solid rockets strapped on to each Solid Rocket Booster - that will be necessary to insure that the Space Shuttle will be able to launch the desired 14,515 kilograms (32,000 pounds) of payload into polar orbit from Vandenberg AFB, Calif.

That capability will be required to use the Spacelab on the West Coast missions.

The extra thrust is needed because of the increased weight of the Shuttle orbiter, John Yardley, NASA's associate administrator for space transportation systems, told the House Subcommittee on Space Science and Applications yesterday. He indicated that at present, the Shuttle is 3,629 kilograms (8,000 pounds) below the planned payload capability for the Vandenberg launches (15,876 kilograms or 35,000 pounds), and about 680 kilograms (1500 pounds) below the planned capability from Kennedy Space Center (29,483 kilograms or 65,000 pounds). He indicated that the strap-on solids could boost the Shuttle payload capability at Vandenberg by 4,536 kilograms (10,000 pounds).

Yardley said that while some might want to consider the need for thrust augmentation a "design failure," he did not consider it in those terms. He pointed out that early in the program, NASA decided to reduce the weight of the orbiter from 79,379 kilograms (175,000 pounds) to 60,039 kilograms (150 pounds), which was set arbitrarily, in order to hold down costs. He said that the cost to build the extra equipment included in that 11,340 kilograms (25,000 pounds) difference [including an atmospheric propulsion system] would have boosted the overall shuttle development cost by 10 to 15 percent; the cost of the thrust augmentation will only boost that cost by 3 to 5 percent. (Defense/Space Business Daily, Vol. 102, No. 33, Friday, February 16, 1979, p 247)

- o Rockwell International Space Division presented the results of several tasks (analysis and tests) dealing with areas of the orbiter where rain-water ingestion can be expected and the effects of such ingestion on the orbiter systems. The problem is extensive and it is very likely that rain-water will intrude into several areas of the orbiter including the payload bay.

Rockwell also made recommendations on how to prevent rainwater ingestion during the first ferry flight (prior to STS-1). These solutions involve closing vent doors, taping over vulnerable spots, removing/replacing panels, etc., in the forward RCS and nose gear wheel well areas. The question of what to do during subsequent ferry flights is still open. These types of solutions will impact Dryden Flight Research Center and KSC OPF ground flows.

Finally, Rockwell made recommendations for KSC pad facility changes (shrouds, etc.) to prevent rain intrusion in the forward fuselage area during pad operations. None of these solutions appeared viable due to funding, technical, or timing (need dates) constraints. An Orbiter solution using burn-away foam or tape (soft shroud concept) appears to be the most practical. (Notes [to Center Director] from Robert H. Gray, 2-15-79)

**February 23:** NASA Associate Administrator John Yardley reported to Congress that because of development problems, \$80 million of work on the Space Shuttle that was planned for FY '78 has been deferred to FY '79, and that a supplemental \$185 million will be needed in FY '79 to continue Shuttle development "at a pace which will minimize total Shuttle development costs." He summed up the current status of the program as follows.

In the past year, substantial progress has been made on the final assembly and checkout of Orbiter 102, leading to a planned delivery to Kennedy Space Center (KSC) in March 1979. However, this progress has taken considerably more time and resources than had been planned, leading to deferral of significant activity in FY '79.

A large increase in the number of secondary structure parts and certain necessary systems changes both contributed to making the final assembly and checkout more complex, time consuming and costly. Changes were required in the hydraulics system, several large helium bottles were added to increase the purge for the main engine seals, and a back-up flight control system was also added. In addition, technical problems, which have been resolved, were encountered in the reaction control thrusters, the auxiliary power system, and the main propulsion system plumbing.

In the production and installation of thermal protection system (TPS) tiles, new processes had to be developed to produce dimensionally correct tiles. There are over 32,000 tiles per orbiter, of many different shapes...This problem was further aggravated by the fact that these tiles must be installed in a sequential pattern. Because of a high rejection rate of individual tiles the TPS installation became inefficient. Operations were often delayed due to non-availability of specific tiles. While the problem of the sequence of manufacturing has been largely solved, substantial deferral of the TPS activity to KSC will be required to meet the early March delivery.

During FY '78 and early FY '79, the main engine deliveries for STS-1 have slipped seven months.

This was principally due to engine test failures and fires with severe damage to three engines: Engine 2001, as a result of a main liquid oxygen (LOX) valve failure; Engine 0007, as a result of a heat exchanger coil failure; and Engine 0006, as a result of a faulty valve and the failure of a repair in the high-pressure fuel turbopump. As a result of these engine problems as well as orbiter TPS problems, the Sept. 28, 1979, target date was revised to Nov. 9, 1979.

During the past year, production of the first flight External Tank encountered a number of problems which caused delay and increased costs.

The first flight tank weld assembly was completed and successfully pressure tested. However, lengthy production delays developed in the application of the extensive thermal protection system on the exterior surfaces of the tank, which increased manpower and funding requirements.

During the past year, Solid Rocket Motor handling and manufacturing problems have caused significant delay and cost increases. Two propellant segments had to be recast; one due to excess porosity, and one due to a handling mishap. Development motor #3 had to be disassembled for repair, resulting in a three month delay in firing. Problems with other components, such as the flexible nozzle bearing and nozzle ablative parts, have resulted in funding increases. In addition, an overhead crane failure required extensive modifications to the three 180-metric ton (200-ton) cranes used for lifting and transfer of motor case segments; this resulted in additional schedule delays. These problems and underestimates in manufacturing operations resulted in a significant growth in funding requirements. (Defense/Space Business Daily, Vol. 102, No. 35, Friday, February 23, 1979, pp 260,261)

- o NASA has decided to conduct all physical integration of Spacelab experiments related to the Space Shuttle at its Kennedy Space Center launch site. The decision follows extensive analysis and cost studies, and confirms an earlier tentative decision to perform the work at Kennedy rather than at the centers charged with managing the Spacelab missions.

Physical integration involves actual installation of the experiments on Spacelab's racks and pallets. When Spacelab operations become routine in the mid-1980's, the physical integration is expected to require about 100 civil service and contractor man-years of work each year at Kennedy.

Analytical work required to integrate experiments for each Spacelab mission will continue to be done at assigned mission management centers.

Spacelab is a scientific facility which will be installed in the payload bay of NASA's Space Shuttle for periodic missions. Scientists and technicians will conduct experiments in Spacelab on Earth orbital missions of seven to 30 days duration. Spacelab is being built by the European Space Agency. (NASA Activities, Vol. 10, No. 2, February 1979, p 11)

- o Two hundred top Air Force and NASA officials met this week at Vandenberg AFB to discuss Space Transportation System (STS) planning.

The conference was scheduled by Major General Richard Henry, commander of SAMSO (Space and Missile Systems Organization) and was hosted by Brigadier General James Marshall, commander of SAMTEC (Space and Missile Test Center).

The purpose of the four-day conference was to orient all of the major Air Force Commands about the STS activation and operational planning for the Vandenberg launch site. A key objective was to uncover action items pertinent to that goal.

About 35 individuals from NASA attended the conference, plus a few of the major aerospace contractors. The remainder were Air Force officials from various commands.

NASA participation included John Yardley, associate administrator for Space Flight; Dr. Walt Williams, NASA chief engineer; Dr. Myron Malkin, director, Space Shuttle Program; and Chet Lee, director, STS Operations; all from NASA Headquarters. A delegation from the Johnson Center was headed by Robert Thompson, manager, Space Shuttle Program Office, and Glenn Lunney, manager, Shuttle Payload Integration and Development Program Office. Senior Marshall Center representative was Ellery May, of the Shuttle Project Office.

Among those representing KSC were Center Director Lee Scherer, Dr. Robert Gray and John Neilon.

KSC coordinator for the conference was Bill Huseonica, who worked in concert with Pat Murphy, manager of KSC off-site operations based at Vandenberg. (Spaceport News, Vol. 18, No. 5, John F. Kennedy Space Center, March 2, 1979, pg 4)

March 1979

**March 2:** The following is a breakdown of the \$4.6 billion FY '81 and \$4.3 billion FY '82 budgets for NASA that have been projected by the White House. The figures have not been adjusted for inflation.

	NASA Budget Outlook (in millions of FY '80 budget dollars)			
	FY '80	FY '81	FY '82	Change: 80-82
Space Transportation Systems				
Space Shuttle	1,366	939	598	-768
Space Flight Ops	467	702	787	+320
Expendable LV's	71	35	19	- 52
Total STS:	1,904	1,676	1,404	-500
Other R&D Programs	1,698	1,824	1,835	+137
Total R&D:	3,602	3,500	3,239	-363
Construction	158	136	136	- 22
R&PM	965	960	960	- 5
Total NASA:	4,725	4,596	4,335	-390

With these budgets, NASA expects to have \$195 million available for new starts in FY '81 and \$500 million available in FY '82.

Adjusted for inflation, NASA's projected outlays in FY '80 will be at their lowest level since the opening years of the space program. According to NASA figures, based on constant FY '66 dollars, NASA's outlays in FY '80 will total \$1.754 billion [actual: \$4.595 billion - the highest total since FY '68] versus \$1,806 billion in FY '79 and \$1,762 billion in FY '78 - the previous nadir. Outlays in FY '66 were \$5.932 billion, dropping annually to \$1.879 billion in FY '75, after which some minor ups and downs occurred. (Defense/Space Business Daily, Vol. 103, No. 2, Friday, March 2, 1979, p 8)

**March 8:** MSFC and KSC agreed to new SRB/SRM delivery schedules to support the November 9, 1979 launch date. These are documented in a March 1 letter to Bob Lindstrom. MSFC is not going to be able to meet many of these dates without alterations to their current planning. MSFC is currently looking at various planning options which will enable them to better their schedule. These include reduction of acceptance checkout of the SRB aft skirts, elimination of TVC hot firing on the right aft skirt, deferral of work to the KSC (PSF), and delivery of the Qual-1 segments to KSC for use as SS-1. (This would delay the qual firing approximately two months.) Each entails some degree of program risk.



Within the next few days, MSFC will complete their review of the various ways of improving their schedules. At that time, MSFC will request we work with them to see if the delivery dates to KSC can be negotiated. (Notes [to Center Director] from Robert H. Gray, 3-8-79)

**March 9:** The Space Shuttle Columbia, which had been scheduled to begin its piggyback flight to Cape Canaveral aboard its 747 carrier aircraft Friday, suffered damage during a test flight at Edwards AFB, forcing a delay in its departure. During the 17-minute test flight on Friday, temporary plastic insulation broke off the spacecraft and hit the tail section of the vehicle, causing what was described as minor damage. The temporary tiles were on the Shuttle to fill in places where permanent ceramic tiles have not yet been installed. None of the permanent tiles broke away during the test flight. A misaligned mounting strut for attaching the Shuttle to the 747 was also found during the test flight on Friday. (Defense/Space Business Daily, Vol. 103, No. 9, March 13, 1979, p 57)

**March 16:** NASA's John F. Kennedy Space Center has awarded a contract with an estimated value of \$323,750 to Allied Chemical Corporation, Morristown, N. J.

Under the terms of the fixed-price contract, Allied Chemical will supply a cleaning solution, Solvent, Type II, for one year to the Kennedy Space Center. The solution will be used in the cleaning laboratory and for flushing the hypergolic systems of the Space Shuttle. (NASA News Release No. KSC 35-79, March 16, 1979)

**March 19:** International utilization of the U. S. space program has contributed \$2.2 billion to the U. S. balance of payments over the past fifteen years, and is continuing to contribute about \$175-\$200 million annually, according to estimates submitted to Congress last week by NASA.

Arnold W. Frutkin, Associate Administrator for External Relations, said the return has included \$1.185 billion from Intelsat launches and related purchases; \$360 million in Japanese purchases; \$125 million in reimbursable launches for ESA; \$360 million in reimbursable launches for other countries; and \$195 million from cooperative projects with other countries, including \$65 million from remote sensing.

Frutkin also reported that other countries have contributed a total of \$1.362 billion to current NASA space science projects - including the \$660 million that ESA is spending to develop the Spacelab. The remainder of the foreign contribution to current NASA projects is being spent as follows (dollars in millions):

- \* Solar Polar Mission (ESA): \$100. Spacecraft, experiments.
- \* Space Telescope (ESA): \$100. Instruments, solar panels, operations support.
- \* IRAS (Netherlands/U. K.): \$60. Spacecraft, ground support.
- \* ISEE (ESA, France, Germany): \$40. Spacecraft, instruments.
- \* Galileo (Germany): \$30. Spacecraft propulsion, instruments.
- \* IUE (ESA/U. K.): \$30. Hardware, ground support.
- \* Spacelab 1 (Japan, France, India, Canada): \$10. Scientific instruments.
- \* SMM (U. K., Netherlands, Germany): \$10. Instruments.
- \* HEAO-C (France, Denmark): \$4. Scientific instruments.
- \* CTS (Canada): \$60. Spacecraft.
- \* Tiros-N Series (France, U. K.): \$50. Data collection system, instruments.
- \* Nimbus 7 (U. K.): \$1. Scientific instruments.
- \* RMS (Canada): \$80. Design and development of system.
- \* Landsat (9 countries): \$75. Ground stations.
- \* Spacelab 1 (ESA): \$20. Scientific instruments.
- \* Seasat/Nimbus 7/HCM (ESA/Canada): \$7. Ground stations.
- \* Biosat (USSR): \$25. Flight of U. S. experiments.

(Defense/Space Business Daily, Vol. 103, No. 13, Monday, March 18, 1979, p 88)

- o Poor weather conditions at Edwards AFB yesterday forced NASA to postpone until today the planned two-day piggyback flight of the Space Shuttle Orbiter Columbia to Kennedy Space Center. The flight aboard a 747 carrier aircraft has already been delayed a week because of problems with plastic dummy heat tiles on the orbiter which peeled off in a test flight. The tiles have since been reglued. Some 3000 of the dummy tiles were needed because installation of the real reusable insulation tiles is behind schedule. In order to save time on the program, NASA decided to fly the Shuttle to KSC without the complete set of insulations and to finish the installation there. (Defense/Space Business Daily, Vol. 103, No. 14, Tuesday, March 20, 1979, p 92)

**March 20:** The Space Shuttle Orbiter Columbia, which flew from Edwards AFB, Calif., to Biggs Army Base in El Paso, Tex., March 20 atop its 747 carrier, made the short trip from El Paso to San Antonio, Tex., yesterday after a one-day weather delay, and is awaiting a break in the weather to fly on to Cape Canaveral. (Defense/Space Business Daily, Vol. 103, No. 17, Friday, March 23, 1979, p 113)

**March 22:** For the first five months of FY '79, KSC actually used 102% of the utility energy used for the similar FY '78 period. To meet our FY '79 goal, KSC must not use more than 98.9% of the actual energy used in FY '78. KSC is, therefore, more than 3% over its energy consumption for the first five months of FY '79. More drastic action will be required to reduce energy demands for the rest of FY '79. Some 70% of the total electrical consumption is required to meet the weekly baseline load. This baseline load is calculated as a week's load consisting of seven Sundays, the day with lowest electricity requirement. Within available KSC resources, we are making an effort to identify what makes up this baseline electrical load. Additionally, a statement of work is being prepared to get NASA Headquarters to assign Grumman to help us make this determination and to recommend areas where FY '79 reductions can be made without adverse impact on KSC mission. (Notes [to Center Director] from P. A. Minderman, 3-22-79)

**March 24:** In recognition of the recent arrival of the first Space Shuttle orbiter at its penultimate destination, President Jimmy Carter said:

"The Columbia, Space Shuttle Orbiter, arrived at NASA's Kennedy Space Center in Florida in late March. Late this year we will be launching Columbia into Earth orbit for the first Shuttle mission.

"Just as landing tests of the Orbiter Enterprise in the summer of 1977 signaled the beginning of the Shuttle evaluation years, the Columbia ushers in a whole new era of economical and routine space transportation. The Shuttle will reduce the cost and increase the effectiveness of using space for commercial, scientific, and national security needs. When Columbia and her sister ships - Challenger, Discovery, and Atlantis - are operational, we will truly be the space traveling nation we set out to become twenty years ago.

"The first great era of space is over. The second is about to begin. It will come into its own with the Shuttle, the heart of our new space transportation system. The Shuttle program has been a very large effort. More than 5,000 companies and nearly 50,000 Americans all across the country have worked in designing, manufacturing, and testing the Shuttle. I congratulate the scientists, engineers, skilled workers, and others that have contributed directly to this success." (NASA Activities, Vol 10, No. 5, May 1979, p 4)

**March 29:** The following changes in the STS Schedule have occurred since the January 1979 reschedule meeting with the NASA Administrator:

	<u>Impact</u>
KSC Plan showed launch on November 15 Administrator announced November 9	1 week
Orbiter O/D was to be March 2 Actual O/D was March 25	3 weeks
SRB initial deliveries were April 20 KSC agreed to May 4, 1979	
KSC Pathfinder reflects "MLP ready for STS-1 stacking" from June 8 to June 22	0
ET O/D was May 22 KSC agreed to June 9	0

STS-1 Additional Schedule Probabilities

Unplanned deferred work to KSC (RAMA's)	TBD
Orbiter project reports possible one-month delay to the April 7 and April 15 APS PODS deliveries	TBD
SSME deliveries have slipped:	TBD

	<u>Old Date</u>	<u>New Date</u>
ENG-1	4/10/79	5/7/79
ENG-2	4/29/79	5/17/79
ENG-3	5/15/79	5/27/79

(Notes [to Center Director] from Robert H. Gray, 3-29-79)

**March 27:** The Space Shuttle Orbiter Columbia arrived safely at Kennedy Space Center atop its 747 carrier airplane at 11:04 AM EST Saturday, after a 93 minute flight from Eglin AFB, Fla., where it spent the previous night. It made a 2 hour and 15 minute flight from Kelly AFB, San Antonio, Tex., to Eglin on Friday.

After landing before a crowd of some 6000 cheering people, the Columbia was unhitched from its 747 carrier and towed two miles to a hangar where it will be prepared for its maiden flight into space November 9. The preparations will include installing some 7800 pieces of reusable surface insulation tiles, that originally were to have been installed in California prior to the flight to Cape Canaveral.

Veteran astronaut John Young, who will pilot the Columbia on its maiden flight along with space rookie Robert Crippen, commented on the landing. "It's a great day for the world. The only sad thing about it is that most of the world doesn't realize it yet. They will."

"Looking at that bird back there you might think that all we need is to wipe the windshield, put it on the launch pad and take off. But it needs engines, it needs more tiles and there is a lot more testing to be done. We're not going to launch that baby until it's ready."

NASA officials have emphasized the latter point, acknowledging that it is more likely that the Shuttle will make its first flight in December, or even January, than in November.

NASA Administrator Dr. Robert Frosch was on hand at Cape Canaveral for the arrival of the Columbia. (Defense/Space Business Daily, Vol. 103, No. 19, Tuesday, March 27, 1979, p 129)

**March 29:** NASA Administrator Dr. Robert Frosch and European Space Agency director Roy Gibson signed a Memorandum of Understanding in Washington, D. C., under which each agency will provide one spacecraft for the International Solar Polar Mission (ISPM) to be launched in 1983 onboard the Space Shuttle. U. S. cost of the ISPM is estimated at \$190 million to \$230 million, with another \$40-50 million to be spent for mission operations and data analysis. The ISPM is the first spacecraft procurement to use the A-109 stipulations. TRW and Fairchild conducted the Phase B studies of the U. S. spacecraft for the ISPM and their proposals for building the spacecraft are due in at the Jet Propulsion Laboratory April 23. One of the companies will be selected next fall to build the spacecraft. Originally known as the Out-of-the-Ecliptic mission, the ISPM spacecraft will observe the Sun for the first time from the plane above the solar poles. (Defense/Space Business Daily, Vol. 103, No. 26, Thursday, April 5, 1979, p 152)

**March 30:** NASA Administrator Dr. Robert Frosch told Congress that all the agency expects to have for basic space transportation in the next ten or twelve years is four or five Space Shuttle orbiters and that a continuous process of improving the system will be conducted over that period.

Testifying before the Senate HUD-IA Appropriations Subcommittee, Frosch said the improvements would involve increasing the Shuttle's power and weight lifting capability; extending its life support capability;

developing its capability for assembling and constructing objects in space; improving its fuel efficiency; developing its capability to dock with objects for resupply; improving operations around the cargo bay, including astronaut activities and automated systems; and developing its capability to support missions in higher orbits. Frosch said that NASA will examine the feasibility of increasing the Shuttle's operational orbit up to 500 or 600 miles as well as whether to conduct those operations via Orbital Transfer Vehicles.

The NASA administrator said that it is probable that NASA will transition to a vehicle beyond the Shuttle in ten, twelve or fifteen years and that planning for that will begin in the mid-1980's.

Frosch estimated the cost of the Thrust Augmentation System for the Shuttle at \$250 million and said it will be needed for follow-on military payloads. He said that NASA expects to make some design changes in Shuttle systems as a result of the Thrust Augmentation system but said they would not be significant. He noted that the system would not be used on every mission. (Defense/Space Business Daily, Vol. 103, No. 23, Monday, April 2, 1979, p 158-9)

**March 30:** Kennedy Space Center director Lee Scherer, commenting on the center's ability to launch the Shuttle on schedule Nov. 9, said: "We just have a very large job with the possibility of a number of surprises which we just can't predict. But it's what we're here for and a challenge that we are anxious to work on, and it's great to have us and the country back this close to manned space flight again." [No American has flown in space since the U. S./Soviet Apollo-Soyuz Test Project in July 1975.] (Defense/Space Business Daily, Vol. 103, No. 24, Tuesday, April 3, 1979, p 168)

- o The Voyager 1 flyby of Jupiter on March 5 has produced the most important discovery of this mission, according to many scientists, and what may be the most significant find of the entire planetary exploration program - several live volcanoes on Io, Jupiter's third largest moon, caught in the act of erupting.

On March 8, Linda Morabito, an astronomer at Jet Propulsion Laboratory, was studying a photograph of Io taken during the flyby. Morabito works on the navigation team at JPL, and was studying the photo for optical navigation purposes. She saw a strange plume rising above the limb, or visible edge of the satellite, one that no amount of picture refining could eliminate.

Morabito realized the possible importance of what she was seeing, and called it to the attention of other scientists on the Voyager team. They confirmed the wildly improbable fact that she had spotted an erupting volcano - and five or six more were seen in other Voyager photographs, taken before the spacecraft had turned its camera to the next programmed target, Europa.

Spectacular though the Io volcanoes are, they must compete with a host of other unexpected and fascinating scientific discoveries. And more are to follow. Having used the gravity and orbital motion of Jupiter to increase speed and change direction, Voyager 1 is now on its way to Saturn. (Spaceport News, Vol. 18, No. 7, John F. Kennedy Space Center, March 30, 1979, p 1)

April 1979

**April 2:** About 600 employees of NASA and Rockwell International have been put on a three-shift, around-the-clock schedule seven days a week at Kennedy Space Center in an effort to keep the Shuttle on schedule for its initial flight November 9. Work is now centered on removing the dummy tiles that were put on the Orbiter Columbia for its flight from California and replacing them with the operational insulating tiles. Since the Shuttle has fallen behind schedule, NASA has been planning the 24-hour schedule at KSC after the arrival of the Columbia. A six-week-long test of the Shuttle's major combined systems is scheduled to start next week. (Defense/Space Business Daily, Vol. 103, No. 23, Monday, April 2, 1979, p 160)

**April 5:** The runway overrun areas have become a nesting area for the Least Tern. This bird is a protected species and efforts are being undertaken to discourage them from nesting on the overruns. The overruns will be sprayed with a thin coat of asphalt to darken the area, as the wildlife experts advise a dark color would not offer an attractive nesting area. Another area has been prepared which should be more suitable for Least Tern nesting.

The use of an asphaltic substance has been checked with the KSC and JSC Safety Offices and with the flight crew.

The entire spraying can be done with KSC equipment and manpower; the cost of materials will be approximately \$3,000. (Notes [to Center Director] from Robert H. Gray, 4-5-79)

**April 6:** NASA's John F. Kennedy Space Center has awarded a one-year, \$6,058,686 contract extension to Wackenhut Services Inc., 3280 Ponce de Leon Blvd., Coral Gables, Fla.

The extension covers the period from April 1, 1979 to March 31, 1980, and is for security and fire support services at the nation's Spaceport. Wackenhut employs approximately 325 people in providing these services.

The new award brings the aggregate value of the parent contract to \$11,301,810. (NASA News Release No. KSC 42-79, April 6, 1979)



- o NASA's John F. Kennedy Space Center has awarded a one-year contract extension to Atlantic Technical Services, Inc., Casselberry, Fla. to provide postal services.

The fixed-price contract for \$816,244 - one set aside for award to a small business firm - brings the total aggregate value of the contract to \$1,913,385 and covers the period from April 1, 1979, through March 31, 1980. (NASA News Release No. KSC 44-79, April 6, 1979)

- o The Senate Subcommittee on Science, Technology and Space Friday approved the \$185 million FY '79 supplemental requested by NASA for the Space Shuttle and added \$49 million to the agency's FY '80 budget request, including \$27 million to maintain the option for the fifth Space Shuttle orbiter and \$5 million to prepare for initiation of the Gamma Ray Observatory (GRO) mission. The subcommittee's bill totals \$4.774 billion.

The House has already approved the FY '79 supplemental and an FY '80 authorization which is \$37 million above the amount requested by the Administration. The House-passed FY '80 authorization is very similar to the measure approved by the Senate subcommittee. That bill will go to the Senate Commerce Committee for mark-up tomorrow.

Only two subcommittee members participated in Friday's mark-up - chairman Adlai E. Stevenson (D-Ill.) and ranking minority member Jack Schmitt (R-N. M.), the former Apollo astronaut. The two men have handled the NASA authorization hearings practically by themselves and have consistently urged a greater space commitment by this country. Both men have introduced bills to set a more ambitious space policy for the United States and are sponsoring legislation to establish an operational remote sensing satellite system. (Defense/Space Business Daily, Vol. 103, No. 28, Monday, April 9, 1979, p 193)

**April 10:** The Space Shuttle Orbiter Enterprise arrives at KSC April 10. The Enterprise is the only Shuttle to have flown to date, having completed a very successful series of glide landings at NASA's Dryden Flight Research Center, California. For the past several months, it has been undergoing mated vertical ground vibration tests at the Marshall Space Flight Center in Alabama; these were completed on February 23.

Enterprise was brought to KSC for fit-checks in the VAB and at the launch pad. The external tank, also used in the test at Marshall, arrived by barge on March 28. Mating the tank with the two stacked inert solid rocket boosters, now being assembled on the Mobile Launcher Platform in High Bay 3, is scheduled for April 18.

Enterprise was taken from Marshall to the Redstone Army Air Field and mated with the 747 Shuttle carrier aircraft. The carrier left Huntsville on April 10 at 1:00 PM EST and made final touchdown on the Shuttle Landing Facility at 2:53 PM EST.

The Enterprise was demated from its carrier aircraft and towed into the VAB, where it will undergo preliminary operations such as removing the tail cone, installed to reduce aerodynamic drag during the ferry flight. Enterprise will be mated to the external tank. This first complete assembly on a Mobile Launcher Platform will be called the "Pathfinder Vehicle."

The Pathfinder vehicle will be used primarily for checking out the mechanical interfaces between the vehicle and the modified extendable platforms in the High Bay. About May 1, the Crawler Transporter will creep into High Bay 3 and lift the Mobile Launcher Platform and its load off the supporting mounts - also a first for KSC. At its usual loaded speed of one mile an hour, the Crawler will carry its 5-million kilogram (11-million pound) cargo to Pad A for a month of similar fit-checks at the launch site.

Pad operations using the Enterprise would include checks of the sound suppression system, flowing the super-cold liquid oxygen and liquid hydrogen propellants, verification tests for the Orbiter Access Arm and Rotating Service Structure, and others. The Payload Ground Handling Mechanism, which will transfer a complete assembled payload from the Rotating Service Structure into the orbiter's large cargo bay, will also be tested at this time.

By early June pad tests will have been completed. The Crawler will bring Enterprise and its fellow test articles back to the VAB, this time into High Bay 1. The SRBs will be recycled and used on a later mission, as will the external tank.

Enterprise became world-famous during its brief flying career at Dryden. A drive by fans of the television series "Star Trek" gave this first shuttle orbiter its name, in honor of the interstellar ship flown by the Star Trek crew. (Spaceport News, Vol, 18, No. 8, John F. Kennedy Space Center, April 13, 1979, p 1&4)

- o The maiden launch of the European Space Agency's three-stage Ariane launch vehicle, a competitor to the U. S. Space Shuttle, has been scheduled for Nov. 3 at the Kourou Space Center in Guiana - six days before the scheduled maiden flight of the Shuttle. Both vehicles had been slated to make their first flights in June of this year, but were delayed by technical difficulties. The full-scale Ariane propellant mockup was erected on the launch pad at Korou Feb. 5 and will remain there undergoing tests until the Ariane flight stages arrive in July. Preparations for the launch will begin in August. (Defense/Space Business Daily, Vol. 103, No. 29, Tuesday, April 10, 1979, p 201)

**April 11:** Lt. Gen. Tom Stafford, Air Force deputy chief of staff for research, development and acquisition, told the Senate Armed Services Committee yesterday that he did not expect the first Space Shuttle flight to be made in November as currently planned. Stafford said it could go in December, "but in my personal opinion, the launch will take place in January or February." He said he still expects the operational flight date of the shuttle to take place in February 1981 and the first Defense Department flight in December 1981. (Defense/Space Business Daily, Vol. 103, No. 31, Thursday, April 12, 1979, p 214)

**April 12:** The president of the Rocketdyne division of Rockwell International, Norman Ryker, said the Space Shuttle has about a 30 percent chance of making its first flight in November. "I think we have a good opportunity to make the November date," Ryker told the 41st annual meeting of the Aviation/Space Writers Association in Houston. "But it is hard to guess because we could have other problems," he said. (Defense/Space Business Daily, Vol. 103, No. 31, Thursday, April 12, 1979, p 215)

- o KSC's Deputy Director Gerald D. Griffin has been selected by the White House to chair an interagency committee which will recommend guidelines on how governmental agencies should perform research and development.

Griffin will serve as chairman of an interagency committee studying the applications of an Office of Management and Budget circular outlining the policy that the government will follow on determining whether work should be performed under contract or by government personnel.

The committee will report to the Office of Science and Technology Policy and the Office of Federal Procurement Policy, both in the Executive Office of the President. Griffin's new assignment is in addition to his regular duties as KSC's deputy director.

The various federal organizations currently handle the management and performance of research and development tasks differently. The committee will recommend a more precise set of guidelines for all government organizations to follow.

Representation on the committee includes individuals from the Departments of Agriculture; Commerce; Defense; Energy; Health, Education and Welfare; Housing and Urban Development; Interior; State; and Transportation, plus the National Science Foundation, Environmental Protection Agency, the Veterans Administration and NASA. (NASA News Release No. KSC 49-79, April 12, 1979)

**April 13:** NASA's John F. Kennedy Space Center has awarded a \$753,182 contract to Thiokol Corporation, Wasatch Division, Brigham City, Utah, to provide on-site solid rocket motor processing activities during the design, development, test and evaluation period of the Space Shuttle.

Under this contract, Thiokol will assist in the final mating of the solid motor segments during stacking operations. This includes the installation of various explosive devices, such as those used to separate the boosters from the shuttle after the solid propellant is consumed, and to release the descent parachutes.

The cost-plus-fixed-fee contract covers the period from January 22, 1979 through March 31, 1980. Work performed under the contract will be done at the Kennedy Space Center. Thiokol has been awarded previous contracts by KSC totaling \$2,930,283. This supplemental award brings the total value of the contract to \$3,683,465. (NASA News Release No. KSC 50-79, April 13, 1979)

**April 18:** More than 75,000 visitors viewed the Space Shuttle Orbiter Enterprise during the five days it was on public exhibition following its arrival at the Kennedy Space Center on April 10.

The Enterprise was flown into KSC aboard NASA's 747 carrier aircraft from the Marshall Space Flight Center in Huntsville, Alabama, where it had been undergoing vibration testing for the past year.

At KSC, it will serve as the "pathfinder" for its sister ship, the Columbia, by supporting the checkout of assembly and launch facilities and ground support equipment.

The Enterprise was on exhibition from April 11-15. During that period, 10,470 cars bearing 41,880 visitors were admitted to the Shuttle Landing Facility and 33,447 patrons of NASA tours viewed the Enterprise as part of their two-hour guided bus tours of KSC.

The peak day was Sunday, April 15, when 5,136 tour patrons and 15,324 people arriving in 3,831 cars visited the Shuttle Landing Facility.

The Enterprise is to be moved into the Vehicle Assembly Building on Wednesday. During the week of April 22, it will be mated with an external tank and inert solid rocket boosters on a Mobile Launcher Platform in preparation for the move to Complex 39's Pad A on May 1. (NASA News Release No. KSC 52-79, April 18, 1979)

**April 25:** NASA Associate Administrator John Yardley said that the problems with the Space Shuttle Main Engine (SSME) appear to have been solved.

However, he reported that installation of the thermal protection tiles on the Orbiter Columbia are about a month behind schedule and that he will know better in the next six weeks whether the Shuttle launch can be made "this year." Launch is officially scheduled for Nov. 9. "At this point, I am not making any guesses until I have more information." He added that the prime contractor, Rockwell, thinks it can make the Nov. 9 date. (Defense/Space Business Daily, Vol. 103, No. 41, Thursday, April 26, 1979, p 290)

**April 26:** Following four months behind the highly successful Voyager 1 spacecraft, Voyager 2 Thursday began taking the first of 15,000 photographs of Jupiter and its moons. Voyager 2 is now 59 million kilometers (34 million miles) from Jupiter and will make its closest encounter 650,000 kilometers (404,000 miles) on July 9. Voyager 1 flew within 278,418 kilometers (173,000 miles) of Jupiter's cloud-tops. Following Voyager 1 to Saturn, Voyager 2 will continue taking pictures of Jupiter until August 28; it will take the first detailed look at the Jovian moon Europa and make more detailed studies of the moon Io. Voyager 1 will arrive at Saturn in November 1980; Voyager 2, in August 1981. An option exists to change the Voyager 2 trajectory at Saturn for a January 1986 encounter of Uranus. (Defense/Space Business Daily, Vol. 103, No. 43, Monday, April 30, 1979, p 300)

May 1979

**May 1:** Greater-than-anticipated problems in developing the Space Shuttle and in readying the Orbiter Columbia for its first flight will require NASA to shift \$270 million from production to development of the Shuttle in FY '79-80, to delay the availability of the vehicles, and to use more than \$400 million of the announced \$690 million "wedge" for new starts in FY '81-82 to make up the production shortfall.

This message was delivered to the Senate Space Subcommittee by NASA Administrator Dr. Robert Frosch, who said that the cost estimates are preliminary and will be further refined by mid-June, when more is known about the projected launch date for Columbia.

He emphasized that the estimates assume that Congress will approve the \$185 million FY '79 supplemental for the Shuttle that has been requested by the Administration. He said the fact that those supplemental funds have not been approved yet is by itself "impacting program pace." He said it became necessary several weeks ago to begin deferring the use of funds for Shuttle production in order to continue funding Shuttle development "at an efficient rate" in anticipation of the \$185 million appropriation.

Frosch said that NASA realized that it had considerably more work to do to get the Shuttle ready for its first flight since the arrival of the Columbia at Kennedy Space Center last month. He said that NASA has had to add more personnel and to extend working times on several elements of the Shuttle, since less work than originally planned was accomplished at the manufacturing sites.

He reported that NASA is currently four to six weeks behind schedule for the planned Nov. 9 launch date for the Shuttle and that launch will probably slip to the first quarter of 1980, although it could occur late this year.

He said that NASA will incur additional costs of \$2.5 million to \$3 million per day for every day the launch slips beyond Nov. 9.

The NASA administrator told the subcommittee that NASA is shifting \$10 million in FY '79 funds that was allocated for the now terminated Tele-operator Retrieval System to Shuttle development and anticipates that it will shift an additional \$70 million in FY '79 from production to development of the Shuttle. In FY '80, he said that the agency tentatively plans to shift \$200 million from production to development.

In other testimony, NASA Associate Administrator John Yardley said that testing of the Space Shuttle Main Engine is going well and that the engine is no longer the pacing item on the program. He indicated that the key item is now the installation of the Thermal Protection Tiles. He reported that Rockwell is going to have to add about 300 people at Kennedy Space Center to work on the tile installation and on other items, including installation of development flight instrumentation inside the Shuttle. He said the people may be hired from such launch vehicle contractors as McDonnell Douglas and General Dynamics, and put the cost of the extra people at \$5-6 million in FY '79.

Yardley said that NASA is not satisfied with prime contractor Rockwell's internal cost management on the orbiter program, and that its award fee will be affected. Deputy Administrator Alan Lovelace said that NASA is going back to all its contractors to get them to review management controls.

Frosch said that cost escalation in the aerospace industry has been above that of the U. S. economy as a whole, which has impacted the program. NASA Comptroller William Lilly said the escalation has been about 9.5-10 percent, or 2 percent higher than expected. Yardley reported that the cost of some components has increased because the industry is "saturated with business" and won't accept fixed prices.

Yardley said that because of the Shuttle production slip, NASA will not require the \$27 million approved by the House in FY '80 for long lead items for the fifth orbiter.

Frosch said that NASA is adding three additional main engines to the Shuttle program, and accelerating deliveries of other engines to protect the engine development program against further test problems. (Defense/Space Business Daily, Vol. 104, No. 3, Thursday, May 3, 1979, p 15-17)

- o The Space Shuttle Orbiter Enterprise was rolled out to Complex 39 at the Kennedy Space Center on May 1 as part of an exercise designed to help clear the way for the launch of its sister ship Columbia. It marked the first time that the complete Space Shuttle configuration had been assembled in the Vehicle Assembly Building and moved to the launch pad. Earlier, a 15-story-tall external tank was mated with two inert solid rocket boosters on a mobile launcher platform.

The Enterprise was delivered to KSC's Shuttle Landing Facility from the Marshall Space Flight Center by NASA's 747 Shuttle carrier aircraft on April 10.

On April 24, the delta-winged orbiter was hoisted from the horizontal to the vertical position, and lifted 58 meters (190 feet) above the floor of the transfer aisle before being swung over a transverse beam and then lowered gently onto the deck of the mobile launcher platform for mating with the external tank. The operation took some 19 hours.

The Enterprise remains at Pad A in Complex 39 until the first week in June. The pad, which was used for all the Apollo lunar missions (except Apollo 10) has been extensively modified for its new role in the Space Shuttle program.

The purpose of this Enterprise operation is to make certain that Shuttle elements are compatible with the Spaceport's assembly and launch facilities and ground support equipment, as well as to verify procedures. It also provides for training of space center personnel in the handling of hardware designed to make space operations more routine and economical in the 1980s. (NASA Activities, Vol. 10, No. 6, June 1979, p 6)

- o NASA Administrator Robert Frosch told the Senate Commerce Space Subcommittee that the flight of the first Shuttle Orbiter, Columbia, is at least 4-6 weeks behind schedule for the Nov. 9 launch, with the first quarter of 1980 the "more probable" launch date. NASA says it has been shifting production money from the second orbiter (099) for several weeks in order to pay for the Columbia's R&D, putting the second orbiter at least 6 months behind schedule. (Defense/Space Business Daily, Vol. 104, No. 2, Wednesday, May 2, 1979, p 9)

May 2: NASA awarded \$3.660 billion in contracts and other procurements in fiscal 1978, an increase of \$128 million, or 3.6 percent, over fiscal 1977, less than the rate of inflation.

The business share of the agency's FY '79 procurements was about 90 percent - the same as it has been for the last three years - including direct award of \$2.954 billion, or 81 percent of all procurement dollars. Direct awards to business totaled \$2.838 billion in FY '77, or 80 percent of the total.

The increase in NASA's procurements last year is the smallest it has been in several years. Procurements of \$3.205 billion in FY '77 were up 10.2 percent from FY '76; procurements of \$3.205 billion in FY '75 were up 5.6 percent from FY '74.



Of the total direct awards to business, \$2.112 billion, or 72 percent, were competitive procurements, compared to 73 percent in FY '77. Of these, \$362 million, or 13 percent of the total awards to business, were new contracts, with \$1.750 billion, or 59 percent, representing within scope modifications to contracts awarded competitively in previous years. Of the \$842 million in noncompetitive procurements, \$271 million, or 9 percent, were new contracts, and \$571 million, or 19 percent, were modifications to contracts awarded previously.

Contracts with incentive provisions accounted for 66 percent of the total awards of \$10,000 and over to business; cost-plus fixed-fee contracts, 13 percent; and firm-fixed price contracts, 17 percent. In FY '77, that breakdown was 69 percent, 13 percent, and 15 percent, respectively.

Small business received \$282 million, or 10 percent, of NASA's direct awards to business last year, including \$137 million, or 22 percent, of new contracts of \$10,000 and over awarded to business. Small business received 9 percent of NASA's contract dollars in FY '77 and FY '76, and 10 percent in FY '75. Including subcontracts, the small business share came to \$513 million, or 17 percent, of the total awards to business in FY '78. This compares to \$496 million and 18 percent in FY '77.

The largest share of NASA's contract dollars continued to go to California last year, which received \$1.280 billion, or 42 percent of the total. This compares to awards of \$1.417 billion, or 49 percent, in FY '77. Florida and Texas were second and third, respectively, each with 9 percent of the total awards, and Maryland was fourth, with 8 percent. No other states received more than 4 percent. (Defense/Space Business Daily, Vol. 104, No. 2, Wednesday, May 2, 1979, p 10)

- o Rockwell International Corp. of Downey, Calif., continued as NASA's leading contractor in FY '78, although its total contracts and share of the NASA contract dollar dropped significantly from FY '77.

Rockwell accounted for 30 percent of all NASA contract dollars awarded to business in FY '78; the top five contractors for 46 percent; the top ten contractors for 57 percent, and the top one hundred contractors for 88 percent (the same as in FY '77).

Eight of the Space Agency's top ten contractors for FY '78 were on that list in FY '77. Hughes (#13 in FY '77, with contracts for \$38.7 million) and Computer Sciences Corp. (#12 in FY '77, with contracts for \$40.5 million) have moved into the top ten, replacing General Dynamics (#11, with contracts for \$64.4 million) and Boeing (#15, with contracts for \$42.7 million). (Defense/Space Business Daily, Vol. 104, No. 2, Wednesday, May 2, 1979, p 10)

- o On Wednesday, May 2, 1979, a press conference was conducted at 9:30 AM at the Visitors Information Center to announce and demonstrate the operation of the solar energy reporter. The solar energy reporter senses, records, and reports by voice, the amount of solar energy striking a unit area. Interested members of the communications media were shown the equipment and told how it can be accessed by phone. Representatives of the Florida Solar Energy Center (FSEC) were also present for this event to assist in the demonstration. It is expected that this solar index will be incorporated in the daily weather broadcasts on radio and TV and will be published in the local newspapers as a public service. (Notes [to Center Director] from Andrew Pickett, 5-3-79)

**May 4:** The FLTSATCOM-B spacecraft was successfully launched into a synchronous transfer orbit by the Atlas-Centaur AC-47 at 1457 hours EDT from the ETR Launch Complex 36 on May 4, 1979.

The transfer orbit parameters are:

	<u>Actual</u>	<u>Nominal</u>
Inclination (degrees)	26.3633	26.3654
Eccentricity	0.732257	0.732294
Apogee Height (KM)	35965.0	35974.6
Perigee Height (KM)	166.5	167.0

The spacecraft apogee kick motor was successfully fired at fifth apogee on May 6, 1979, injecting the FLTSATCOM spacecraft into the desired synchronous orbit. All spacecraft systems were turned on and are operating nominally.

FLTSATCOM is an advanced Earth satellite designed to provide extensive communications capability for the USAF and USN. The satellites are to be placed in synchronous, near equatorial orbits. The spacecraft provides 23 UHF and one SHF communications channels. Services provided are: Fleet broadcast, channel 1; Fleet relay, channels 2 through 10; Air Force narrowband, channels 11 through 22; a DOD wideband, channel 23; and an additional Telemetry, Tracking and Command (TT&C) S-band channel. (Prelaunch Mission Operations Report No. M-491-202-79-02, subj. FLTSATCOM-B Launch, May 1, 1979, p 1. Also, Post Launch Mission Operations Report No. M-491-202-79-02, subj; FLTSATCOM-B Post Launch Report, November 5, 1979)

**May 7:** The leadership of the Senate Commerce Committee and its Space Subcommittee has asked NASA to provide a fuller explanation of why the estimated cost of the Space Shuttle program increased by \$400-\$600 million in a matter of months without anyone knowing about it, or at least not informing the Congress, and to immediately initiate actions to prevent a reoccurrence of such a situation.

In a letter May 3 to NASA Administrator Frosch, Commerce chairman Howard Cannon (D-Nev.), subcommittee chairman Adlai E. Stevenson (D-Ill.) and subcommittee ranking minority member Jack Schmitt (R-N. M.), said they were "dismayed" at the cost overrun on the Shuttle and said the failure of NASA to inform Congress of the problems "is most regrettable." They warned that the current situation "seriously threatens the committee's credibility, as well as NASA's."

Concerning the launch delay and sharply increased costs of the Shuttle, the Senator said:

"It is not clear whether Rockwell International [Shuttle prime] underestimated the work to be accomplished to support a Nov. 9, 1979, first orbital test flight, whether Shuttle program managers at the various levels were unaware of the situation, or whether, and at what stage, top NASA management was informed of the need for the prompt availability of additional funds for Shuttle development. However, it is clear that the situation did not develop in the past 30-60 days. This raises a basic question with respect to the adequacy of the Shuttle management system to track and report program progress and financial status. If the fault does not lie in the estimating process, or the management system, then there was laxity in advising the committee about a serious problem that obviously required immediate attention."

Accordingly, the three men called on the NASA administrator to immediately initiate a thorough review of the Shuttle situation, to identify specific failures, and to prepare a statement of corrective action initiated or proposed. They said they want a report from NASA on these matters before they take NASA's FY '80 authorization bill to the Senate floor. (Defense/Space Business Daily, Vol. 104, No. 8, Monday, May 7, 1979, p 31)

**May 10:** During the move of "Pathfinder" to Pad A, the performance of the Crawler Transporter was closely monitored for correlation of speeds versus vibrations, since this was the first time the Shuttle flight configuration has been transported by the CT. Strain gauges and accelerometers on the vehicle/MLP were monitored, and no excessive readings were recorded.

Conclusion:

- 0.75 Best speed for turns
- 1.0 Best speed for open road
- 0.4 Best speed for road crossings

The C/T was propelled at 1.0 MPH on all straight-of-ways when tests were not controlling speeds. (Notes [to Center Director] from P. A. Minderman, 5-10-79)

**May 11:** President Carter submitted an amended FY '80 NASA budget to Congress requesting an additional \$220 million to pay for the increasing costs of developing the Space Shuttle.

Without the additional funds, NASA was going to have to transfer some \$220 million from Shuttle production to Shuttle development in FY '80, causing delays of at least 9 and 12 months in the third (103) and fourth (104) Space Shuttle orbiters, and increasing the costs of the program by an estimated \$400-\$600 million.

The need for those orbiters to launch military satellites, particularly those involved in monitoring a SALT Treaty, is believed to be a key factor in the President's decision.

As it is, NASA is going to have to transfer some \$70 million in FY '79 from Shuttle production to Shuttle development [along with \$185 million in supplemental funds], delaying readiness of the second orbiter (099) as well as 103 and 104.

As a result of the FY '79 funding shift, the delivery date of 099 has been slipped from September 1981 to March 1982; the delivery of 103 from December 1982 to June 1983, and the delivery of 104 from December 1983 to June 1984.

If the additional \$220 million requested by the President in FY '80 is not approved, the delivery dates of 103 and 104 will be slipped to March 1984 and June 1985, respectively. The 099 schedule will remain the same.

Launch of the first Orbiter (101), officially scheduled for Nov. 9, is now expected in January or February 1980. (Defense/Space Business Daily, Vol. 104, No. 11, Tuesday, May 15, 1979, p 77)

**May 13:** During the week of May 13-19, the John F. Kennedy Space Center will join with other NASA centers and government agencies to observe Small Business Week, honoring the country's small businesses.

During the last fiscal year, KSC awarded \$37.3 million in contracts to small business firms. Of that total, \$25.9 million went to small Florida-based firms, with many of the contracts granted to local businesses.

Jack Dryer, Industry Advisor and Small Business Specialist from KSC's Procurement Office, noted that KSC has awarded \$16.5 million to small business firms through the end of March, the halfway point for Fiscal Year 1979.

More than \$173 million in contracts have been issued to small business since fiscal year 1970.

KSC participates in some programs and has initiated others designed to help small businesses win contracts. All procurement requests exceeding \$2,500 are reviewed by Dryer to determine if they can be set aside for small business firms, thus precluding competition from large firms. And all construction work estimated to be less than \$1 million is reserved for small business. (NASA News Release No. KSC 65-79, May 8, 1979)

**May 15:** The House HUD-IA Appropriations Subcommittee, in closed-door session, approved the additional \$220 million for the Space Shuttle in FY '80 that had been requested by the President at the last minute -- funds that will ensure earlier availability of the four Orbiter Shuttle fleet and increase the likelihood that major funding will be available in FY '81 and FY '82 for new starts.

The \$220 million was approved as part of a \$4,910.5 million FY '80 appropriation for NASA, a reduction of \$34.5 million from the President's amended request.

The subcommittee also approved the \$185 million FY '79 supplemental for the Space Shuttle, which has already been approved in the House authorization bill and in the Senate Commerce Committee authorization. The added \$220 million was requested after the authorization committees had acted, but is quite certain of winning approval in those bodies. Still to be faced is Senator William Proxmire's Senate HUD-IA Subcommittee.

The \$34.5 million reduction was made as follows:

- \*Space Shuttle Thrust Augmentation System: -\$15 million. NASA requested the funds to define a system of added solid propellant motors that would increase the payload capability of the Shuttle in polar orbit missions from Vandenberg, a capability that will be needed in about 5 or 6 years.

- \*Space Flight Operations: -\$5 million. This reflects the general cut made in the FY '80 NASA authorization by the House.

- \*Computer Acquisitions: -\$3 million. Leaves \$7 million in the budget.

- \*Construction of Facilities: -\$1.5 million. For a hangar at Edwards AFB.

- \*Research & Program Management: -\$10 million.

In one other action, the subcommittee directed NASA not to exceed the \$116.1 million FY '80 budget for the Galileo Jupiter Orbiter Probe, to come back with a supplemental request if additional funding is needed. It was estimated that the total cost of the program could increase by \$25 to \$50 million as a result of needing to reduce the weight of the Inertial Upper Stage to give it the payload capability to boost the Galileo, which earlier had weight problems of its own. (Defense/Space Business Daily, Vol. 104, No. 13, Thursday, May 17, 1979, p. 85-6)

**May 17:** NASA has named six men, working under Deputy Administrator Dr. Alan Lovelace, to make a 3-1/2 month review of the Space Shuttle management system and cost problems that have occurred on the Shuttle, and to report their findings by Sept. 1.

The review is being conducted in response to a request from the Senate Commerce Committee and its Space Subcommittee that NASA fully explain why the costs of the Shuttle have suddenly increased by \$400 to \$600 million, and to take corrective actions.

NASA Administrator Frosch has indicated that NASA has some problems in monitoring costs by its prime contractor, Rockwell International, and by sub-contractors, as well as some communications problems within the agency. In addition, he said there may be problems with NASA's planning and prediction approaches, and in the way the agency organizes and controls certain aspects of the work on the Shuttle program.

The management review team consists of four current NASA officials, two former NASA officials, and one Air Force official. They are: Dr. Richard C. McCurdy, former NASA associate administrator-organization and management; Willis H. Shapley, former NASA associate deputy administrator; Maj. Gen. James Abrahamson, program director for the F-16, USAF; A. Thomas Young, deputy director, NASA-Ames Research Center; John E. O'Brien,

assistant general counsel-procurement, NASA-Headquarters, and Abraham Spinak, associate director, NASA Wallops Flight Center (executive assistant). (Defense/Space Business Daily, Vol. 104, No. 13, Thursday, May 17, 1979, pg 89)

**May 18:** Two companies have responded to requests for proposals to manage and operate the public visitation program at NASA's John F. Kennedy Space Center.

The firms making proposals for the 10-year concession agreement were ARA Services, Inc., Philadelphia, Pa., and TWA Services Inc., Chicago, Ill., the incumbent concessionaire.

The proposals are undergoing evaluation by a government panel prior to selection of the concessionaire.

Involved in the 10-year concession agreement will be the operation of the guided bus tours of the Kennedy Space Center and Cape Canaveral Air Force Station, as well as the management and operation of the public visitor program. (NASA News Release No. KSC 67-79, May 18, 1979)

**May 22:** A suit was filed in Federal Court in Cleveland to require NASA to provide precise information on where pieces of the orbiting Skylab Space Station will fall. The suit, by attorney Jeffrey Largent, seeks to force NASA to reveal to the public "what danger there is and what they are going to do to ensure safety." Skylab reentry is now predicted for between June 26 and July 9, with 400 or 500 pieces of metal expected to hit the Earth along a path 6,437 kilometers (4,000 miles) long and 161 kilometers (100 miles) wide. NASA has said that it is impossible to determine exactly where the debris will land. It has been studying whether or not to make some maneuvers with the station to try to affect its reentry to enhance safety, e.g., to bring it down largely over the ocean, but any maneuver would entail uncertainty. (Defense/Space Business Daily, Vol. 104, No. 16, May 22, 1979, p. 109)

**May 24:** Mr. Floyd Roberson, Office of Space & Terrestrial Applications (OSTA), NASA Headquarters, requested information on completed or contemplated technology transfer effort in the medical field at KSC which would particularly benefit the handicapped and aged. Thirteen items were listed which would directly or indirectly benefit this group. Included were Computer Diagnoses Program, Prosthetic Leg, Skin-Implant Multiwire Connector,

Tracheal Intubation, Hearing Aid, and Image Enhancement. The information was needed for a Congressional inquiry on what NASA is doing in the way of medical help to the aged and handicapped. (Notes [to Center Director] from Andrew Pickett, 5-24-79)

**May 25:** The first stage of the European Space Agency's Ariane launch vehicle has apparently successfully completed its first qualification test. The stage fired for the full-duration 139 seconds in a test May 17 at SEP in Vernon, France, and initial analysis found that operations were "satisfactory." A second test is planned for early fall. The second stage of the Ariane, which began testing Oct. 16, is "practically qualified," while the third stage has completed six tests in a propulsion bay. Maiden launch of Ariane is scheduled for Korou, Guiana, in early November. (Defense/Space Business Daily, Vol. 14, No. 19, May 25, 1979)

**May 29:** Kennedy Space Center Director Lee R. Scherer announced today the retirement of Walter J. Kapryan, Director of Shuttle Operations, and the appointment of George F. Page to fill that position, effective June 1.

Kapryan's first assignment with NASA was at the Langley Research Center in Virginia. He joined that organization in September 1947, when Langley was headquarters for the National Advisory Committee for Aeronautics. He was assigned to the NASA Space Task Group at Langley in March 1959. Shortly thereafter, he was appointed project engineer for the Mercury Redstone 1 spacecraft and came to the Cape Canaveral area in 1960 with that spacecraft.

During the early phases of the Gemini Program, Kapryan was responsible within the Gemini Program Office for the test planning and determining requirements for spacecraft checkout equipment to be located at KSC.

In 1963, he established and headed the MSC Gemini Program Office at KSC. He participated in the preparation and countdown of all manned Gemini flight and all Apollo Saturn 1B and Saturn V missions.

Prior to assuming his present position in September 1969, Kapryan held the position of Deputy Director of Launch Operations. Previously, he was Assistant Apollo Spacecraft Program Manager at KSC, representing the Manned Spacecraft Center, assuring close coordination between the two centers in spacecraft positions. (NASA News Release No. KSC 100-79, May 29, 1979)



**May 30:** A crack in the nozzle of a Space Shuttle main engine, discovered hours before a Thursday cluster firing of three of the engines, has caused a 10- to 20-day postponement of the critical test, TODAY has learned.

"The crack was found about 9:30 Wednesday night when we were X-raying the engine for any flaws," an official close to the engine development program said.

The engine, one of three to be used in the cluster firing, seemed to have no problems during previous test firings, the official added.

"But to be on the safe side we decided to halt the scheduled test and to repair the crack," he said.

The cluster firing, which is scheduled to run 520 seconds - the length of time the Shuttle engines must operate in order to get the space transportation system into orbit - is considered a major milestone in the development of the Shuttle's main propulsion system. (Dick Baumbach, "Engine Crack Delays Test," TODAY, Cocoa, Florida, Friday, June 1, 1979)

During May: Center secretaries and clerical personnel were in the spotlight late last month, as KSC celebrated National Secretaries Week with special programs and speeches, including a visit from three astronauts.

Over 280 civil service and contractor secretaries attended the program in the training auditorium, where Ellen Horn received the Secretary of the Year Award.

Astronaut Bob Crippen, who will fly in the first Space Shuttle, and astronaut-candidate Judith Resnick each gave a short talk at the program.

A highlight of the activities for many of the secretaries was the reception held in the Mission Briefing Room, where they had an opportunity to meet and talk with the astronauts. (Spaceport News, Vol. 18, No. 10, John F. Kennedy Space Center, NASA, May 11, 1979, p. 2)

- o After being in mothballs for the past four years, the KSC Astronaut Quarters have undergone a facelifting and are now ready for the Shuttle era.

Included in the 6,818 square feet that make up the Shuttle crew members' temporary work and living areas are fourteen bedrooms, two lounges, a dining room, kitchen conference room, gymnasium, six bathrooms, a sauna, and laundry room.

The astronaut quarters offer comfortable accommodations for the crew members during their days of pre-flight preparations. The last seven days before a flight the crew will be in isolation, and only individuals designated as prime contacts will be allowed within the confines of the facility.

Each crew member will have his or her own bedroom, complete with bed, dresser, chest of drawers and night stand. An office area offers desks and working space for the crew to study the Operational Management Instructions, Countdown Procedure documents, or other last minute details of their pending flight.

Two lounges within the crew quarters provide a living room atmosphere to read, watch television, or listen to stereo music. Six large tiled bathrooms are shared, roughly one for each suite of three bedrooms.

A stainless steel kitchen with adjoining dining room is included in the area, and a conference room complete with plaques of the Apollo missions and world map is available for meetings of up to 25 persons. The dining room was used during manned space programs for the traditional crew breakfast before each flight.

To keep the astronauts and mission specialists in tip top physical condition, a fully equipped gymnasium within the isolation area is available for exercising, and a sauna bath is nearby to aid them in relaxing after a rigorous day.

A glass observation window located at the east end of the quarters will allow family members and others who need to talk directly to the crew members to do so during the quarantine period. Communication is by way of a telephone and speaker system. A commercial upright freezer provides storage space for the food which will be stowed aboard the spacecraft for a particular flight. The prepared food will be transported from NASA's Johnson Space Center in Texas.

The entire astronaut quarters have undergone minor modifications and major interior decorating under the direction of Nancy Gunter, who was selected for the job of Manager, KSC Astronaut Office last May. (Spaceport News, Vol. 18, No. 11, John F. Kennedy Space Center, May 25, 1979, p. 6)

June 1979

**June 5:** NASA Administrator Dr. Robert Frosch reported to Congress that the first launch of the Space Shuttle has definitely "slipped into 1980" and said that problems on the program are widespread but correctable.

Frosch attributed the delay in the Shuttle launch, which had been rescheduled for Nov. 9 and then estimated for late 1979, to four factors: 1) the late arrival of the Orbiter Columbia at Kennedy Space Center; 2) incomplete manufacturing and assembly work on the Orbiter by Rockwell before it was transferred to KSC; 3) slower-than-expected installation of the Thermal Protection System (TPS) tiles; and, 4) additional modifications which delayed testing and checkout.

Frosch reiterated that of all the problems, the TPS installation is the "most severe." He said that there are still about 8,000 tiles to be installed on the Orbiter and that NASA has only achieved an installation rate of about 200 tiles per week, instead of the 650 per week planned. At the current installation rate, the Orbiter insulation system would not be ready before next March. However, steps are being taken to improve the situation.

Although the Main Propulsion Test of the Space Shuttle Main Engine cluster was postponed last week, Frosch reported that SSME testing is "proceeding at a good pace." Approximately 46,000 test seconds of engine operations of the 80,000 seconds planned for certification for the first flight (STS-1) have been achieved. Previous major engine development problems "have been overcome and residual turbine problems are now being analyzed," he said.

As a result of problems on the Shuttle, Frosch reported, prime contractor Rockwell's award fee for the last half of 1979 was cut 32 percent below maximum [from about \$5.8 million to about \$4 million]. Performance fee was affected by problems with the TPS; cost fee, by Rockwell's inability to estimate cost increases resulting from the previous year's problems.

As for corrective management actions, Frosch cited the following:

--At Rockwell. The company has restructured its subcontracts management office by integrating the technical managers and the cost managers into a single unit, a step which will allow cost increases and technical problems to be recognized sooner. Rockwell has also added to its subcontracts management team; has established an improved system for tracking subcontractor budget impacts on a monthly basis; and plans more reviews with its subcontractors to prepare resource requirements.

--At Kennedy Space Center. Leadership and lines of authority at KSC have been clarified regarding the Shuttle. The KSC Shuttle manager has been placed in charge of all KSC elements working on the Shuttle, and Johnson Space Center has been given full responsibility for completing the installation and assembly of components on Orbiter 102. Studies are underway on simplifying administrative areas at KSC, both by NASA and Rockwell.

--At Headquarters. In addition to the Space Shuttle management assessment being undertaken by an independent team, NASA comptroller William Lilly is undertaking a detailed review of Shuttle cost and scheduling. A Shuttle resource requirements review team will analyze the FY '81 Shuttle budget requirements and future year projections in detail, including assessment of the contractor and vendor estimates, to fully examine the basis of the cost estimates and to test the adequacy of the resources considering the potential for future changes. It will be used in supporting NASA's FY '81 budget submission to the White House. (Defense/Space Business Daily, Vol. 104, No. 27, June 7, 1979, p. 184-5)

**June 10:** The Senate by voice vote has passed the \$4.961 billion FY '80 authorization for NASA recommended by its Space Subcommittee, an increase of \$16 million over the amount requested by the Administration. There was no debate on the authorization.

The bill includes the \$220 million additional requested for the Space Shuttle by the President in May. The House has passed a NASA authorization that is \$37 million above NASA's original request, but does not include the \$220 million. The funding, however, will be included in the final bill to be worked out in House/Senate conference.

The Senate bill includes \$3,838.5 million for R&D, \$16 million above the request and \$199 million above the House bill; \$157.6 million for construction, which is identical to NASA's request and to the House-approved amount, and \$964.9 million for Research & Program Management, which is identical to the request and the amount approved by the House.

The Senate R&D authorization is comprised of the following (in millions): Space Shuttle, \$1,586; Space Flight Operations, \$467.3; Expendable Launch Vehicles, \$70.7; Physics & Astronomy, \$337.5; Planetary Exploration, \$220.2; Life Sciences, \$43.9; Space Applications, \$334.3; Technology Utilization, \$12.1; Aeronautical R&T, \$309.3; Space R&T, \$119.4; Energy Technology, \$5; and Tracking and Data Acquisition, \$332.8

Senate increases include \$2 million for the Multi Spectral Resources Scanner; \$4 million for the Variable Cycle Engine; \$5 million for Rotorcraft Technology; \$2 million for Energy Technology, including the SPS; and \$3 million for Large Space Structures.

House additions are \$27 million for the fifth orbiter [funds no longer required in FY '80]; \$2 million for the MSRS, \$4 million for the National Oceanic Satellite Systems, \$1 million for the Large Space Antenna, \$8 million for the VCE. It cut \$5 million from Space Flight Ops.

The House Appropriations Committee cut \$34.5 million from the NASA request, including \$15 million for Shuttle Thrust Augmentation, \$5 million for Space Flight Ops. and \$10 million from Research and Program Management. (Defense/Space Business Daily, Vol. 104, No. 36, Wednesday, June 20, 1979, p. 247)

**June 22:** Sunday drive-through tours of the Kennedy Space Center and Cape Canaveral Air Force Station in private vehicles were suspended until further notice due to the gasoline supply situation.

Guided bus tours of the NASA Space Shuttle base on KSC and the operational and historical sites on Cape Canaveral Air Force Station will remain in operation. (NASA News Release No. KSC 123-79, June 22, 1979)

**June 25:** The following is a breakdown of the annual budgets for NASA for the FY '81-84 time period [along with FY '79-80 for comparison] as projected in NASA's current Five-Year Plan.

An in-house working document, the plans seek to lay out the programs that the agency should undertake for the benefit of the nation in the specified time period and which are within its technical capability.

The plan, however, is tempered by the budget realities imposed by the White House Office of Management & Budget -- an effect which is evident in the program delays from those projected last year -- including the postponement beyond FY '84 of such major and expensive undertakings as the Saturn Orbiter Dual Probe and a follow-on Mars mission.

Further such changes -- both postponements/cancellations and some newly discovered initiatives -- can be anticipated in each new Five-Year Plan.

Already the current projection for the FY '81 budget is being modified as a result of the increased costs on the Shuttle program and by an overall ceiling being imposed by OMB. An increase above this year's budget adjusted for inflation is not anticipated.

Of the \$21.4 billion contained in the Five-Year Plan for FY '81-84 [in FY '80 budget year dollars], a total of \$5.9 billion is projected for new programs, i.e., money both to initiate new projects in FY '81-84 and to carry them out in the four-year period.

This new program money totals \$450 million in FY '81, \$1.350 billion in FY '82, \$2 billion in FY '83 and \$2.1 billion in FY '84. The FY '81 "wedge," including sixteen prospective new starts, will certainly be affected by the additional development costs of the Shuttle.

The new Five-Year Plan is notable for the new Space Systems Engineering project line; for a more than doubling of annual Applications funding from the current level, and for a near doubling of Aeronautics funds.

[Note: the Plan does not include the \$220 million requested by the President in May for the Space Shuttle in FY '80.] (Defense/Space Business Daily, Vol. 104, No. 39, Monday, June 15, 1979, p. 269)

**June 28:** The first orbital flight of the Space Shuttle has slipped at least until the end of March 1980 and probably will not be conducted until the end of June 1980 at the earliest.

NASA Administrator Dr. Robert Frosch told the House Space Subcommittee that there is a 20 percent chance that the initial flight could be made in March and a 50 percent chance that it could be made by the end of June.

He said that if all goes well on the Shuttle program, the basic work on the Orbiter Columbia could be completed in November and it could be moved to the Vehicle Assembly Building at KSC before Christmas. He said the March launch might be possible if the Orbiter does not have to be returned to the VAB from the pad before launch, and if there are no unforeseen major difficulties.

[The last official date for the Shuttle launch was November 9, but recent problems pushed that into "early 1980." The Shuttle was originally slated to fly in March 1979.] (Defense/Space Business Daily, Vol. 104, No. 43, Friday, June 29, 1979, p. 295)

**June 30:** After serving millions of people in communities throughout the world, NASA's experimental Applications Technology Satellite-6 was turned off June 30 and boosted to a higher orbit. The five-year old communications satellite, positioned in a geostationary orbit 35,900 kilometers above the equator in the central Pacific Ocean, exceeded its planned life span by three years.

Three of its four station-keeping thrusters had failed and the lifetime of the fourth thruster became questionable. Should its fourth thruster have failed, the spacecraft would have drifted between its old position above 140 degrees W. longitude and 70 degrees W. longitude, creating a potential hazard to present and future spacecraft in that orbital area. To prevent such an occurrence, controllers at the Goddard Space Flight Center on Aug. 6 used the remaining thruster to boost the spacecraft several hundred kilometers higher, where it will remain in orbit for hundreds, perhaps thousands, of years.

The 1,402-kilogram spacecraft has a 9-meter diameter mesh antenna which can be pointed within a tenth degree of arc, directly toward small ground receiving stations. This capability to transmit directly to small ground receivers provided unprecedented experimental opportunities to bring educational, scientific and health programs to communities throughout the world. Previously, huge ground stations were needed to receive and amplify the relatively faint signals, after which the video and sound had to be retransmitted overland, via conventional methods, to local television sets. (NASA Activities, Vol. 10, No. 8, August 1979, p. 7)

**During June:** For the twelfth year in a row, the Kennedy Space Center achieved over 90% participation in the Federal Savings Bond Campaign, and has earned another star for its Minuteman Flag.

KSC came out ahead of the other Centers in this year's campaign, with 93.4% employee participation. Langley Research Center was second with 83.6%. (Spaceport News, Vol. 18, No. 13, John F. Kennedy Space Center, June 22, 1979, p. 1)

July 1979

**July 2:** The external tank scheduled for flight on the first Space Shuttle orbital mission was shipped from the Michoud Assembly Facility near New Orleans aboard the NASA barge Poseidon.

It was scheduled to arrive at Port Canaveral Friday morning, proceed up the Banana River and reach the KSC barge basin south of the Vehicle Assembly Building by noon. The average speed of the barge and its powerful tug for the 1,073-mile journey from Michoud to Port Canaveral is 10 knots. (Spaceport News, Vol. 18, No. 14, John F. Kennedy Space Center, July 6, 1979, p. 1.)

- o More than 100 scientists and engineers and the payload-handling flight crew for the Spacelab-1 mission toured KSC.

The tour of KSC's launch and payload processing facilities was conducted as part of a four-day meeting of the Spacelab-1 Investigators Working Group held at the Orlando Hyatt House from June 26-29.

Two mission specialists - Astronauts Owen Garriott and Robert Parker and five payload specialists, Dr. Michael L. Lampton, University of California; Byron K. Lichtenberg, Massachusetts Institute of Technology; Dr. Ulf Merbold, West Germany; Dr. Claude Nicollier, Switzerland; and Dr. Wubbo Ockels, The Netherlands, participated in the sessions.

Two of the payload specialists will be selected for the first flight. (Ibid., p. 3.)

- o The prime contractor for the Space Shuttle Orbiter, Rockwell International Corp., told Congress that the increased costs on the program are due to changes in the program that are largely to be expected and to the "constrained budget management" system on the program which requires deferral of work each year.

These changes consist of "new program requirements, additional effort required to accomplish existing tasks, and added effort in response to test program results."



George W. Jeffs, president of RI's North American Aerospace Operations, said that under constrained budget management, a fixed amount of funds covering "only absolutely essential costs" are provided at the beginning of a fiscal year and often are not enough for the work to be accomplished.

While NASA maintains some reserves, there are "no provisions in Rockwell's budgets for contingencies, or changes in the work content that may occur during the year. When mandatory changes are identified, either internally or by NASA, some other program tasks have to be deferred to later time periods," he said.

"Since a major portion of the program is subcontracted, these revisions normally occur to both Rockwell and our subcontractors' baselines. Inherent, therefore in this complex process is a time lag in establishing the magnitude of costs deferred to subsequent years."

This does not occur on programs where new dollars are provided for changes as they occur, he added.

Jeffs said that "such additions" to the Shuttle program annually have approached 25 percent of the baseline content, meaning that the company can never accomplish all of the work that it was originally directed to do in a given year.

According to Jeffs, a substantial unplanned effort was added to the program in FY '78. In June 1978, NASA said that funds for the new work were not available and directed RI to stay within the FY '78 funding limits.

NASA was advised that RI was concerned about the potential magnitude of the effort of this defined work in FY '79 funding, and that it was going to take time to assess the cost and schedule impact." In fact, it took about three months.

Because of the delay in identifying increased costs, Rockwell's award fee on the Orbiter was reduced.

He said that NASA explained that Rockwell was not up to "standard" in identifying costs, but "in actuality, there is no standard for measuring performance in providing such visibility while operating in a constrained budget management system," Jeffs said. Therefore Rockwell protested the NASA action.

The House Subcommittee on Space Science & Applications was told that Rockwell is going to need additional funding to produce the follow-on orbiters on the current schedule.

While its contract calls for \$356 million in FY '79 (and \$559 million in FY '80) and delivery of Orbiter 103 in December 1982, funding has in fact been cut to \$256 million in FY '79. Therefore, to even have the orbiter ready by the summer of 1983, increased funding will be required. He said that such a timetable would be possible but demanding, requiring doubling and then tripling of RI's efforts relative to 1979, in 1980 and 1981, respectively.

Concerning the problems related to completing Orbiter 102 (Columbia) and flying it to Kennedy Space Center, Jeffs insisted that the "configuration management system is excellent. There is no evidence of inadequacies nor of its violation as it relates to Orbiter 102." (Defense/Space Business Daily, Vol. 105, No. 1, Monday, July 2, 1979, pp. 2,3.)

**July 6:** Although NASA says it has no plans to conduct a suborbital maiden flight of the Shuttle Orbiter Columbia in order to test the adherence of the Orbiter's 33,000 insulation tiles during ascent, NASA Administrator Frosch acknowledges that there is a question about the staying power of the tiles, a potentially critical problem.

Reports cite concern about the possible failure of one tile resulting in a series of tiles being pulled off ("zipper effect").

If the tiles should fail during ascent, orbital flight and the potentially fatal heat of reentry could be avoided by an abort maneuver -- which is basically what the proposed suborbital flight amounts to. However, such a maneuver would place increased stress on other systems -- particularly the Space Shuttle Main Engine's and pilot performance on landing.

Asked about the situation, Frosch replied: "The issue is a simple one. Are our predictions of the aerodynamic forces on [Shuttle] ascent correct? Simply put, will the tiles stay on?" (Defense/Space Business Daily, Vol 105, No. 4, Friday July 6, 1979, p. 28.)

**July 6-9:** Two major pieces of flight hardware, essential to pushing Columbia into orbit on that historic first flight of the Space Shuttle, recently arrived at KSC. On July 6 the NASA barge Poseidon docked at the turn basin with the massive external tank. The 46.9-meter (154-foot) long propellant tank, built at NASA's Michoud facility in Louisiana, holds the 1,892,700 liters (500,000 gallons) of liquid oxygen and hydrogen which power the orbiter's main propulsion system. Upon arrival, the tank was transported to the VAB. It was hoisted into the ET checkout cell in High Bay 2 on July 9 and is currently undergoing checkout operations. (Spaceport News, Vol. 18, No. 16, July 20, 1979, p. 1)

**July 9:** NASA's Voyager 2 spacecraft flew by the cloudtops of Jupiter at a distance of 404,000 miles and a speed of 45,225 mph at 7:21 PM EDT Monday and is continuing to operate well.

A surprise in the flyby was a radiation level three times higher than expected. As a result NASA turned off an ultraviolet instrument as a precaution, but said it had no problems with the other instruments on the spacecraft.

The most dramatic revelation in the photographs returned by the spacecraft was that the surface of the moon Europa, which is believed to be made up of ice and slush, possibly to the dept of 60 miles, is covered by hundreds of cracks, some as wide as 30 miles and as long as 2000 miles, but no deeper than a few hundred feet. The photographs show no sign of topographic relief on Europa. It was theorized that the surface cracks are caused by strains in the ice, possibly from a tide-like flow. (Defense/Space Business Daily, Vol. 105, No. 7, Wednesday, July 11, 1979, p. 45.)

**July 11:** The Skylab saga came to a successful end shortly after noon when the 77.5-ton space station reentered the Earth's atmosphere over the Indian Ocean, dropping its surviving large fragments and most of its smaller pieces into the ocean, with a few small pieces coming down over Australia. There were no reports of damage; there were several reported sightings of what was believed to be Skylab fragments over Australia.

NASA had put the station into a tumbling mode at 3:45 AM EDT from the Madrid tracking station, a move which was designed to extend its stay-time in orbit about 30 minutes and insure that the reentry did not occur over North American where it would have at the earlier reentry time. The maneuver was the last available to the agency to affect the reentry.

The station's demise came six years and two months after it was put into space by a Saturn V booster. The last crew left the station in February 1974. NASA had originally estimated that Skylab would remain in orbit well in the 1980's, when it could have been reboosted by the Space Shuttle to a higher, longer-life orbit for use in future operations. Unanticipated sunspot activity caused the early reentry.

The last official decay prediction issued by the North American Air Defense Command Space Defense Center said that entry occurred at 12:37 p.m., EDT, on July 11, give or take two minutes.

Coordinates given by NORAD for the point where the heaviest debris lost its forward velocity, at an altitude of 10 kilometers, were 31.8 degrees south latitude and 124.4 degrees east longitude. That was over the small Australian community of Kalgoorlie in Western Australia.

Soon after launch on May 14, 1973, problems with the unmanned Saturn workshop had to be corrected by the first crew of astronauts sent up on May 25.

In all, three crews of astronauts were to call Skylab home for varying periods of times.

The crews and their missions were: Pete Conrad, Joe Kerwin and Paul Weitz, May 25 to June 22, 1973, 28 days, 50 minutes; Al Bean, Owen Garriott and Jack Lousma, July 28 to Sept. 25, 1973, 59 days, 11 hours and 9 minutes; and Gerald Carr, Ed Gibson and Bill Pogue, Nov. 16, 1973 to Feb. 8, 1974, 84 days, 1 hour and 17 minutes. The final mission held the record of longest manned mission until surpassed by a Soviet crew of cosmonauts in 1978.

Nearly 300 scientific and technical investigations were performed during one or more of the three manned missions and sometimes even for unattended operation between missions. These included medical experiments on man's adaptation to zero gravity; intensive studies of the Sun, with a major scientific accomplishment in the monitoring of a solar flare; and detailed Earth resources experiments. (NASA Activities, "The Skylab Spectacular," Vol. 10, No. 8, August, 1979, p. 3. Also, Defense/Space Business Daily, Vol 105, No. 8, Friday, July 12, 1979, p 54.)

**July 13:** One of Columbia's three Space Shuttle main engines, #2006, arrived July 10 by truck from the National Space Technology Laboratories in Mississippi. There the 2,994-kilogram (6,600-pound) power plants, each producing 1,668,000 newtons (375,000 pounds) of thrust at liftoff, were fired to certify them for flight. A second flight engine, #2005, arrived July 13. Both engines have since been installed on Columbia. The third engine is set to arrive by the end of July. (Spaceport News, No. 16, July 20, 1979, p. 1.)

**July 16:** Florida Governor Bob Graham was the featured speaker at a special program, Monday, July 16, at the Kennedy Space Center, to commemorate the 10th anniversary of the launch of Apollo 11, man's first lunar landing mission.

The program, which was sponsored by the Apollo 11 Commemoration Association began at 8 a.m. with a breakfast at the Visitor Information Center. It was followed at 8:30 a.m. by a special program in the VIC's Theater 1. Besides Gov. Graham, other speakers on the agenda included: George H. Hage, Apollo 11 mission director, NASA Hdqs; Maj. Gen. David M. Jones, USAF (Ret), former commander of the Air Force Eastern Range; Dr. Walter Kapryan, KSC's former director of Space Vehicle Operations and deputy director of Launch Operations for Apollo 11; and KSC's current director, Dr. Lee R. Scherer. Robert Murkshe, former mayor of Cocoa Beach, served as master of ceremonies and introduced the speakers.

After the program, the group viewed a film clip of the Apollo countdown, with the film ending at the exact moment of liftoff -- 9:32 a.m. EDT -- from Pad A of Launch Complex 39. To mark the anniversary, a five by ten foot cake at the main entrance of the VIC was cut by Gov. Graham, Dr. Scherer and H. B. Chambers general manager of TWA Services, Inc., which operates NASA Tours for the Kennedy Space Center.

The spectacular Apollo 11 mission and the manner in which it was accomplished were recalled by old friends, VIPs, members of the news media, and tour visitors gathered at the Visitor Information Center.

Governor Graham paid tribute to those involved in the historic Apollo 11 mission. Also participating in the eulogy on stage were Dr. Walter J. Kapryan, deputy launch director for Apollo 11, recently retired; KSC Director Dr. Lee R. Scherer; George Hage, Apollo 11 mission director and now a vice president of Northrop Aviation, Inc.; Major General David Jones, USAF Ret., who served as commander of the Air Force Eastern Test Range during the Apollo 11 launch; and Robert P. Murkshe, co-chairman of the commemorative breakfast with George Meguiar, TWAS marketing manager.

Later Graham presented Scherer with his proclamation calling for July 16-24 to be known as United States Space Week. (Spaceport News, Vol. 18, No. 17, August 3, 1979, p. 3, also, NASA News, Release No. KSC 133-79, July 11, 1979.)

**July 17:** On Tuesday July 17 at 11:30 a.m., KSC management held a background briefing on the remaining manufacturing work to be done on the Space Shuttle Orbiter Columbia prior to its first flight.

The manufacturing work continues to be the responsibility of the Johnson Space Center even though the Columbia has been moved from the contractor's plant on the west coast to the Orbiter Processing Facility at the Kennedy Space Center.

The briefing also gave local media representatives the opportunity to meet Kenneth S. Kleinknecht, who had recently been assigned by JSC as Orbiter Vehicle Manager, and Astronaut Robert Overmyer, Deputy Manager. Robert Olson, Manager of TPS Engineering for Rockwell International also participated in the briefing.

In addition to an explanation of the method and problems of installing the Thermal Protection System (tile) the briefing covered the remaining manufacturing tasks such as installation of the developmental flight instrumentation and wiring. (NASA News, Release No: KSC 135-79, July 13, 1979).

**July 23-25:** The Space Coast Chapter of Federally Employed Women, FEW, recently held its annual installation and awards banquet.

Jean String, outgoing president, was honored as Member of the Year. Among her accomplishments noted were "dynamic leadership, effective communication, and chapter growth." Membership was increased by 18% during her term in office.

FEW's Distinguished Service Award was presented to Hugh W. Harris, chief, Public Information Branch, for "consistently demonstrating his belief in the FEW principles of equal employment opportunity for women, minorities and the handicapped."

This year's recipient of the FEW community scholarship, Kathleen Gilroy, a BCC student with a 4.0 average and a major in computer science, was also honored.

Newly installed officers for 1980 in the Space Coast Chapter included: Sandra Parker, president; Edna Hooper, first vice president; Marilyn Pagni, second vice president; Harriet Springer, recording secretary; Jan Jatz, corresponding secretary; and Clara Odom, treasurer. Jo'Gay, regional representative for FEW and outgoing president of Surfside Chapter, installed the new officers. (Spaceport News, Vol. 18, No. 16, July 20, 1979, p. 4).

**July 24:** Completing nearly three months of extensive mechanical fit checks of KSC assembly, checkout and launch facilities, from May 1 to July 23, the Space Shuttle Orbiter Enterprise was rolled back to the VAB. Its mission was to clear the way for the launch of its sister ship, Columbia.

"The Facility Verification Vehicle program, as it was officially termed, was undertaken to prove out KSC facilities and methods for prelaunch operations," said John Bell, who managed the exercises for the STS Processing Directorate. "All in all, we've done just that."

"We've found some instances where planned methods needed revising, while we improved timelines for other operations, such as the transfer of the vehicle to the pad. We performed fit checks in High Bays 1 and 3 and at the pad, and as a result, found some access interference problems. Action is being taken to correct those problems."

The non-launchable Space Shuttle began its journey from Launch Complex 39's Pad A to the VAB at 10:23 a.m., July 23. The shuttle underwent several days of fit checks, similar to those conducted in High Bay 3 during assembly operations, before being destacked.

The Orbiter Enterprise was taken down on July 25 and was transported to the Shuttle Landing Facility.

The 47 meter (154-foot-tall) external tank built by Martin Marietta, will be loaded onto a NASA barge about August 16 for the three-day voyage back to the Michoud Assembly Facility in New Orleans. There it will be refurbished for use on a later shuttle mission.

Two weeks will be needed to break down the dummy solid rocket boosters into their individual components. While the forward assemblies will accompany the external tank on its trip to New Orleans, the inert solid motor segments will remain here until the live motor segments arrive sometime this fall. The inert segments will be returned to Thiokol in Utah on the same rail cars which bring in the real segments. They will be refurbished and loaded with propellant for use on a later shuttle flight. (Spaceport News, Vol. 18, No. 17, August 3, 1979, p. 1).

- o The third of the three Space Shuttle Main Engines which will power the Space Shuttle Orbiter Columbia on its maiden flight next year, passed its flight acceptance test last week at Marshall Space Flight Center, successfully firing for 520 seconds, the flight firing time. The engine will be shipped to Kennedy Space Center later this month, joining the other two engines which passed their acceptance tests earlier and were shipped to KSC several weeks ago. One of those engines is presently being installed in the Columbia. NASA is hoping to make the first Shuttle flight as early as March 1980, but acknowledges that it is more likely that the flight will not be made until late June/early July. (Defense/Space Business Daily, Vol. 105, No. 16, Tuesday, July 24, 1979, p. 109.)

**July 26:** The Senate Appropriations Committee has approved the \$4,943.5 million FY '80 appropriation for NASA that was recommended by its HUD-IA Subcommittee last week, a cut of \$1.5 million from the request. In approving all of the requested R&D funds, the subcommittee adopted a proposal by Sen. Charles McC. Mathias (R-Md.) to cut \$4 million from Space Flight Operations, \$10 million from the Shuttle Thrust Augmentation System and \$3 million generally, while adding \$4 million for the Variable Cycle Engine, \$2 million for the Multi-Spectral Scanner, \$4 million for the National Oceanic Satellite System, \$5 million for rotorcraft technology and \$2 million for energy technology. The House as approved a \$4,910.5 million appropriation for the agency, including the \$1.5 million construction cut, a \$15 million cut in thrust augmentation and a \$4 million cut Space Flight Ops. The Senate appropriations bill may get to the floor as early as July 27. (Defense/Space Business Daily, Vol. 105, No. 18, Thursday, July 26, 1979, p. 123).

- o The Senate by voice vote has approved the \$4.961 billion FY '80 authorization for NASA as recommended by Conference Committee, an increased of \$16 million over the amount requested. (Ibid, p. 123).



August 1979

**August 1:** The House has passed and sent to the White House the \$4.961 billion FY '80 NASA authorization agreed to by Conference Committee. The bill is \$16 million over the amount requested, which includes a mid-year \$220 million addition requested by the President to meet rising costs on the Space Shuttle program. The additions made by Congress include \$4 million to initiate development of the National Oceanic Satellite System, \$2 million to initiate development of the Multi-Spectral Scanner, \$5 million to initiate an advanced rotorcraft technology development program, \$4 million for increased work on Variable Cycle Engine technology and \$2 million to identify and verify potential energy initiatives -- funding which is replicated in the Senate version of the NASA appropriations bill. (Defense/Space Business Daily, Vol. 105, No. 22, Wednesday, August 1, 1979, p. 152.)

**August 3:** The Space Shuttle Orbiter Enterprise was opened to viewing by visitors taking guided bus tours of the Kennedy Space Center from noon, Friday, August 3, until its departure aboard NASA's 747 Shuttle Carrier Aircraft on Friday, August 10.

The Enterprise was flown into KSC's Shuttle Landing Facility aboard the NASA 747 on April 10 and had been used since its arrival to check out the assembly, test and launch facilities which will be used for the launch of its sister ship Columbia on its first flight into space in 1980.

The Enterprise was moved Friday morning from the Vehicle Assembly Building to the Shuttle Landing Facility. It was positioned adjacent to the Mate/Demate Device to await the arrival of the Shuttle Carrier Aircraft which will fly it to Atlanta on Friday, August 10, on the first leg of a five-stop hop to NASA's Dryden Flight Research Center in California.

The Shuttle Carrier Aircraft will arrive at KSC on August 8, mating operations will be conducted on August 9 and the 747/Enterprise combination is scheduled for take-off at 11 a.m. EDT on August 10. (NASA News, Release No.: KSC 145-79, August 3, 1979.)

- o The John F. Kennedy Space Center, NASA in cooperation with the United States Postal Service, offered a cancellation service to interested philatelists for the space flight programs at KSC.

The cancellation service previously offered by the KSC Exchange Council for a fee has been discontinued. (NASA News, Release No.: KSC-144-99, August 3, 1979.)

**August 9:** The Western Union Telegraph Company's WESTAR-C satellite was launched into a synchronous transfer orbit from the Eastern Test Range at 8:20 p.m., EDT, on August 9, 1979, by a Delta 2914, Vehicle Mission Number 149.

Performance of the Delta launch vehicle was nominal and placed the spacecraft and its apogee boost motor (ABM) into the desired transfer orbit. The orbital elements achieved compared with the nominal expected, are as follows:

	<u>Expected</u>	<u>Measured</u>
Apogee (km)	36,709	36,681
Perigee (km)	231.3	230.8
Inclination (degrees)	24.28	24.34

The satellite performed satisfactorily during the transfer orbit and the ABM was fired successfully at 10:30 a.m., EDT, on August 11, 1979. The satellite was maneuvered to a position 91 degrees West longitude above the equator and satellite status was satisfactory.

The Westar-C spacecraft was originally built for WUTC by Hughes in 1973 as a backup to the Westar-A and -B missions (Westar-1 and -2 satellites). However, Westar-1 and -2 were launched successfully (on Delta) in April and October 1974, respectively, and have continued to operate satisfactorily in orbit since then. Therefore Westar-C has not been needed and has been in storage. The Delta vehicle built for the Westar-C backup mission thus has also been unneeded and in storage. Mod #10 to the Tracking and Data Relay Satellite System (TDRSS) contract between WUTC and NASA includes agreement that NASA would launch the Westar-C satellite for storage in orbit to be available as backup to the commercial segment of TDRSS.

The Westar-C spacecraft was built by Hughes Aircraft Company under contract with WUTC and is designed to provide transmission of television, voice, data, etc., throughout the USA. The System is capable of distributing analog or digital signals with overall performance comparable to that of terrestrial methods. (Mission Operation Report, MOR No. M-492-203-79-03, August 7, 1979. Also, Mission Operations Report, MOR No. M-492-203-79-03, October 25, 1979.)

- o A recent meeting at KSC with Johnson Space Center and Rockwell International representatives indicated that over 2500 tiles would have been inspected after the first flight because of a restricted usage classification.

A decision on the negative margin tiles should be made by the end of this week. So far, 1047 tiles have been affected with approximately 600 requiring removal from OV-102. Over 300 tiles will be given a pull test with a new tool arriving at KSC August 15, 1979. (Notes...Page [to Center Director], 8-9-79.)

- o NASA has received a \$10,000 claim from a Turkish Cypriot. Although it was in English, the letter was hard to follow. Recovery for the disruption of his tourist or travel agency business was the basic request. He said airline flights were delayed or canceled because of the Skylab re-entry and he had to house and feed stranded travelers. (Notes...Parry [to Center Director], 8-9-79, p. 25.)

**August 10:** The Space Shuttle Orbiter Enterprise left KSC aboard its 747 Shuttle Carrier Aircraft for NASA's Dryden Flight Research Center. Portions of the electronic equipment inside the Enterprise will be removed and later installed on future shuttles. The shell will be put on permanent display. (Spaceport News, Vol. 18, No. 18, John F. Kennedy Space Center, August 17, 1979, p. 1.)

**August 16:** The International Ultraviolet Explorer (IUE) was judged successful based upon the results of the mission with respect to the approved prelaunch objectives.

The IUE, an Explorer-class ultraviolet astronomy mission, was an international cooperative program between the United States, the United Kingdom (UK), and the European Space Agency (ESA) which provided for a single launch into a geosynchronous orbit to conduct spectral distribution studies of celestial and solar system ultraviolet sources. The spacecraft and scientific instrument were designed and fabricated at the Goddard Space Flight Center. The spectrograph camera system was provided by the UK; ESA provided the Solar Array as well as the European Ground Station.

The IUE observatory system was designed to functionally resemble a ground-based optical observatory at which guest observers could execute observing programs in real time. Observations were made from ground stations at GSFC and Madrid, Spain.

In the 15 months since IUE commenced routine guest observer operations on April 3, 1978, Observatory performance has substantially exceeded design and mission objectives. At high resolution, spectra of stellar sources has been obtained as faint as 12th magnitude while at lower resolution, observations have been made of extragalactic sources fainter than 17th magnitude. The latter observations required 3-axis stabilized pointings in excess of 14 hours, continuously.

The secondary mission objectives have also been met. The IUE gyros have been selected for Space Telescope (ST) use; the IUE Spectrograph is a forerunner of the ST High Resolution Spectrograph; the IUE cameras have influenced the design of detectors for the ST Faint Object camera; and the IUE operational software and guest observer operations will provide an experience base for ST.

In addition to the high quality of the output, the data productivity is also great. NASA guest observers have obtained over 6000 images supporting more than 100 difference research programs. The UK and ESA guest observers have produced almost 3000 images in support of 150 or so research programs. (Mission Operations Report, Post Launch Report No. 2, MOR No. S-868-78-03, August 16, 1979.)

- o Arguing against proposals to cut the Shuttle fleet from four to three Orbiters, NASA cited the considerably higher operations costs of the smaller fleet, due in large part to the need to maintain and use expendable launch vehicles with that fleet.

"The cost to launch payloads on an expendable launch vehicle is considerably higher than using the STS" (Space Transportation System), NASA Administrator Frosch pointed out. "For example, current experience shows the cost to a user to launch a Delta sized payload on STS is about 1/3 to 1/2 the cost required to use the Delta vehicle. In the case of a Titan sized payload, the STS costs about 2/3 as much as the expendable system.

"The NASA/DOD Joint Study on Shuttle Fleet Size Analyses in 1978 showed that in the case of the '487' Mission Model, operations costs increased from \$15 billion to \$20 billion (33 percent) as the Orbiter fleet size was reduced to 3 Orbiters and augmented with expendable vehicles," Frosch reported. "With a 25 percent reduction in payloads, the study still showed about a 15 percent increase in operations costs for a 3-Orbiter fleet augmented with expendable launch vehicles above those required when the STS provided the full transportation needs for those payloads."

NASA said that it would cost about \$200 million (FY '80 dollars) annually to maintain a launch capability for the current stable of expendable launch vehicles -- Delta, Atlas and Titan -- plus a procurement/integration cost of about \$300 million to \$500 million (FY '80 dollars) annually for a program of about 10 launches a year involving a mixture of vehicles similar to what is being launched today.

In addition to the launch cost for a nominal Space Shuttle mission, which may be about \$28 million, NASA recently developed these preliminary estimates for extra Shuttle services:

- \*Extra Days in Orbit. About \$300,000 to \$400,000 per day (1975 dollars) for non-NASA and non-DOD users for flights launched from Kennedy Space Center.

- \*Payload Retrieval. About \$300,000 to \$500,000 plus the cost of each additional day on-orbit, provided that the payload to be retrieved is on a compatible delivery mission orbit.

- \*On-Orbit Assembly Of Structures. About \$100,000 to \$250,000 for each Extra-Vehicular Activity (EVA) required for the work.

- \*On Orbit Payload Checkout. About \$300,000 to \$400,000 for each day on-orbit required for the work.

- \*EVA. About \$60,000 to \$100,000 for a six-hour activity.

According to NASA, "determination of a charge for extra days in orbit is dependent on whether or not the Space Transportation System is operating at full capacity, e.g, all flights filled, with the Orbiter being turned around as quickly as possible.

"If the requested time on-orbit exceeds the nominal Shuttle capacity," it said, "additional charges may be required for kit usage (cryogenics, other consumables, solar arrays, etc.)." (Defense/Space Business Daily, Vol. 105, No. 33, Thursday, August 16, 1979, p. 229.)

**August 24:** A 10-year concession agreement designed to enhance facilities and services at the Kennedy Space Center's Visitors Center has been awarded to TWA Services Inc., Chicago, Ill.

Involved in the agreement is the operation of the guided bus tours of the Kennedy Space Center and Cape Canaveral Air Force Station as well as management and operation of the Visitors Center.

TWAS has been concessionaire for KSC's public tour and visitor program since its inception in 1966. The firm was selected in July for negotiation of the new 10-year agreement as a result of a competition announced by KSC on January 24.

The 10-year agreement is effective May 1, 1980 and includes an option for five additional years. Under the agreement, TWA Services will invest up to \$8,501,000 in construction of new visitor facilities.

Among the projects contemplated are:

1. a 500-seat theater
2. Exhibits Maintenance Building
3. Exhibits Building
4. West Parking Lot and New Entrance Road
5. Moonscape and Lagoon
6. Central Receiving Building
7. Interconnecting Walkways and Landscaping
8. Rehabilitation of Saturn 1/1B Blockhouse 37 and Development of an Audio-Visual Presentation
9. IMAX (large screen format) Theater
10. New Food and Souvenir Facilities

The visitors program is basically self-supporting, but NASA does provide some facilities, property and services for the concessionaire's use. (NASA News, Release No. KSC 155-79, September 27, 1979.)

**August 30:** The House Subcommittee on Space Science & Applications criticized NASA for allowing the costs of the Space Shuttle development program to exceed earlier estimates and leveled special criticism at the agency for not expeditiously informing Congress of the increasing costs.

At the same time, the subcommittee said that NASA may need additional funding in FY '80 for the Space Shuttle, charging that the agency had underestimated the annual costs of the Shuttle for fiscal years 1977, 1978, 1979 and 1980.

In a 79-page report issued August 30, the subcommittee made the following recommendations to improve cost management on the Shuttle program. It did not, however, identify any major weakness in the technical management of the program.

\* NASA should name a financial assessment team above the level of the Office of Space Transportation to annually assess the schedule and cost status of the Shuttle.

\* NASA should reaffirm a cost and schedule commitment for Shuttle DDT&E and establish and submit to Congress a firm schedule and cost commitment for completion of Shuttle production.

\* NASA should not "routinely" use production funds as a source of program reserves for Shuttle DDT&E. This practice has made program manager "feel more comfortable" with the level of reserves "than was warranted despite the significant increase in Orbiter unit production costs which resulted from this practice," the subcommittee said.

\* NASA should develop financial planning methods that will size program reserves to be consistent with the program risk. The current system is to constrain annual funding below requested levels and to make up deficits with reserves held at Headquarters. Some results of this system have been "deferral of work, drastic fluctuations in contractor and subcontractor manpower levels, and delays in material procurement which increased the program schedule and cost risk in future years." Secondly, the system has so preoccupied program managers that "they were unable to assess the future cost and schedule impacts of their short term decisions."

\* NASA should make particular effort during the remainder of the Shuttle development program to "minimize changes and other actions affecting program cost and schedule which do not directly involve flight safety."

\* NASA, its prime contractors and subcontractors should develop improved methods for assessing the short and long term impact of "work deferral" and "roll-through" from one fiscal year to the next.

\* NASA, its prime contractors and subcontractors should improve their reporting system to identify the costs resulting from changes that have been authorized by NASA but not incorporated into the contract. "Repeated underestimation of annual funding requirements indicates that sufficient attention has not been given by NASA nor the contractor to estimating the cost impact of anticipated changes to the contract," the subcommittee said.

\* NASA should improve its assessment of the impact on cost and schedule of work deferrals caused by internal management decisions -- to make it equal to assessments of work deferrals caused by OMB decisions.

\* NASA and Rockwell should place increased emphasis on financial management at the Orbiter major subsystem level; to achieve increased cost discipline, each major subsystem technical manager should have a clear understanding of the fiscal year and total runout cost target for their respective subsystems. Lack of information about funding allocations "causes uncertainties in contractor planning and can contribute to over-optimistic scheduling of work load." Forty percent of the Orbiter subcontractor cost growth has resulted from fluctuations in manpower due to fiscal year funding constraints, with another 38 percent due to directed and approved changes to the subcontracts.

The subcommittee also made these observations:

-- Shuttle Design. "There appears to be a high degree of confidence in the integrity of the Space Shuttle system design." However, there are major areas which could result in schedule slippage and additional cost increases, including system qualification testing, the thermal protection system tile installation, main propulsion test completion, and the auxiliary power unit design.

-- NASA Candor. Information presented to the subcommittee by NASA in the fall of 1978 and in February 1979 "was less than candid with regard to serious funding problems which were under consideration within NASA."

-- Administration Support of Shuttle. When considering budget priorities, the Administration has not adequately recognized the urgent and critical national need of the Space Shuttle system for civil and military applications."

-- Size of Cost Growth. "The cost of growth of approximately 15 percent for a program the magnitude and complexity of the Space Shuttle is not inconsistent with previous experience of high technology development programs."

Subcommittee chairman Don Fuqua (D-Fla.) indicated that he believed that most of the Shuttle cost problems had come from lack of an adequate budget rather than to poor management by NASA.

"The Space Shuttle program has been austere from the very beginning and program reserves have been inadequate to cope with cost growths and schedule delays, which have resulted from work deferrals from one year to the next throughout the life of the program," he said.

He added that the cost growth on the program is "damaging the prospects for future science and applications programs," and said "NASA must demonstrate and reestablish its credibility with regard to controlling cost growth and forecasting budget requirements." (Defense/Space Business Daily, Vol. 106, No. 1, Thursday, September 6, 1979, pp. 13, 14.)

**August 31:** The Center Director approved a reorganization of AD on August 31. It deleted the Space Utilization Staff from AD-MSO (responsibility transferred to DE), and reorganized the Resources Management Office (AD-RMO). Two branches were added to AD-RMO to provide co-located support to the Directorate of Cargo Operations and the Cargo Projects Office. In addition, the Center Resources Planning Staff (AD-CPS) was reassigned to AD-RMO, without change of title or functions, and became AD-RMO-RP. (Notes -- [to Center Director], 9-13-79, p. 12.)

- o Tour patronage of NASA's John F. Kennedy Space Center topped the 1 million mark in August, the fifth consecutive year that more than 1 million visitors have taken the guided bus tours of the nation's Spaceport and adjacent Cape Canaveral Air Force Station. Cumulative tour volume for the year through August was 1,007,347, or 1.3 percent below the same period of 1978.

A total of 141,077 took tours in August, a volume 9.7 percent below the 156,164 recorded during the same months in 1978. Although overall tour volume for the month was down, as fears of gasoline shortages around the state eased, patronage during August steadily increased. Tour patronage at the beginning of August was down 26.6 percent from a year ago, as compared to the end of the month figure. (NASA News Release No.: KSC 160-79, September 17, 1979.)



- o Pieces of Skylab found by Stanley Thornton, Jr., a 17 year old Australian truck driver, won him \$10,000 from the San Francisco Examiner newspaper. The prize had been offered to the first person to find debris from the space station that reentered the atmosphere on July 11, 1979. Thornton visited KSC as part of a U.S. tour. (Spaceport News, Vol. 18, No. 18, John F. Kennedy Space Center, August 17, 1979, p. 2.)

September 1979

**September 1:** Pioneer 11 performed a flyby of the planet Saturn and its beautiful ring system. The spacecraft was targeted to pass through the plane of the rings outside of the outermost ring, loop around the planet, and pass outside the rings on the opposite side. This route, chosen to verify that Voyagers would be safe taking this path when the first arrives in 1980, provided the first photographs of Saturn's rings from the shadowed side, away from the sun. The probe also obtained enough data to indicate Saturn probably has a rock core the size of Earth, high-altitude methane clouds (which may be in bands like Jupiter's), and that it emits more energy than it receives from the sun. Pioneer 11 also photographed Saturn's largest moon, Titan and possibly located two new smaller satellites. If confirmed, these will be the first moons ever discovered by a spacecraft prior to being found by telescopes on Earth. (Spaceport News, Vol. 18, No. 21, John F. Kennedy Space Center, September 28, 1979, p. 4.)

- o NASA's Pioneer 11 spacecraft reached the giant ringed planet Saturn on Sept. 1, after a six-year, three-billion-kilometer journey across the solar system.

And, according to the chief Pioneer scientist, the encounter has increased knowledge of the planet and its spectacular rings a thousandfold. Scientists have already listed more than 565 new discoveries, including a previously undetected ring and an 11th moon.

Pioneer 11 took the first closeup pictures and made the first close measurements of Saturn, its mysterious rings and several of its satellites, including the planet-sized Titan.

Sweeping through the most intense part of Saturn's massive radiation belts, Pioneer came within 21,400 km of the planet and as close as 1,900 km to the Saturnian rings. Closest approach was at 2 p.m. EDT, Sept. 1.

The images returned by Pioneer 11 (also called Pioneer Saturn) are providing five to six times more detail of the planet than the best of the pictures taken from Earth.

Information returned by the spacecraft is expected to contribute to a better understanding of the origin and evolution of the Sun and planets. This, in turn, should provide scientists with a greater knowledge of the Earth.

Data obtained by Pioneer 11 also will be useful in planning the encounters of Voyager 1 and 2 with the ringed planet in 1980 and 1981. The Voyagers are now Saturn-bound after 1979 encounters with Jupiter. (NASA Activities, Vol. 10, No. 10, October, 1979, p. 3)

- o Richard G. Smith, in recent months the primary NASA spokesman for Skylab developments, became director of the NASA Kennedy Space Center in September.

He succeeded Dr. Lee R. Scherer, who was named Associate Administrator for External Relations at NASA headquarters, effective Sept. 2, 1979. Smith most recently served as Deputy Associate Administrator for Space Transportation Systems. Before that, he was deputy director of the Marshall Space Flight Center.

Before Scherer became director of the Kennedy center in January 1975, he had served as director of NASA's Dryden Flight Research Center, Edwards, Calif., from Oct 11, 1971. Earlier he was director of the Apollo Lunar Exploration Office. While on temporary assignment from the U. S. Navy in 1962, he was program manager for the Lunar Orbiter, the unmanned spacecraft which obtained close-up photographs that helped in the selection of Apollo landing sites. (Ibid, p. 16)

- o The Hurricane Control Center was activated at 10:25 a.m. on Saturday, September 1 in the anticipation of Hurricane David. All Center-wide hurricane preparations were coordinated from this Center during Conditions 4, 3 and 2. The all clear was given at 4:00 a.m. on Tuesday, September 4, however, the Hurricane Control Center remained manned until 2:30 p.m. to assure clean up work proceeded according to plans and schedules. (Notes... Minderman[to Center Director], 9-6-79.)

**September 4:** One of this century's worst hurricanes, David, roared through KSC September 3. But the monster storm, responsible for at least 1,200 deaths in the Dominican Republic and more than \$22 million in damages to Brevard County alone, caused relatively minor destruction to KSC's launch and processing facilities, support shops and administrative offices. For that, the Center thanked the efforts of 600-700 people responsible for implementing the Hurricane Preparedness Plan to the last minute detail.

KSC's damage assessment group estimated Hurricane David did between \$88,000-\$100,000 in damages to KSC facilities. The largest chunk of that total, about \$26,000 was for repairs to the VAB roof which Design Engineering believed may have been caused by a small tornado spawned from the massive hurricane.

For 32 hours, from 8 p.m. September 2 when KSC went into Condition 1 - marked by winds of more than 50 knots (57 mph) within 12 hours - until the all clear was sounded, about 150 rideout team personnel kept watch on David as it danced along Florida's East Coast, then slapped Brevard County with winds of more than 80 miles per hour. It brushed east of the Center about midnight and calls began coming into the Hurricane Control Center that winds had suddenly stopped as the calm of David's eye settled over the Cape.

Within 12 hours of the all clear, KSC's damage assessment group reported to Deputy Director Gerald Griffin with favorable results of a quick-look survey. Overall damage was light. (Spaceport News, Vol. 18, No. 20, John F. Kennedy Space Center, September 14, 1979, pp. 1,3.)

**September 6:** During Hurricane David, one section of roofing was blown off near the southwest corner of the VAB. The vapor barrier was intact, but the asphalt fill was missing in an area approximately 25' x 60'. The work involved included cutting back to solid foundation and placing light weight concrete in the area where the asphalt fill material was missing. The vinyl topcoat was to be sprayed on the surface after the concrete cures. Some handrail was also missing in the area where the roof was damaged. One other section of roofing, 10' x 20', in the northeast area was missing. Some cable tray damage occurred, two ventilators were damaged, and one drain was plugged. Estimated cost for repair was \$25,000 for City Roofing and \$5,000 for BSI maintenance to temporarily seal the open areas until City Roofing returned to the job site. (Notes...Clark [to Center Director], 9-6-79.)

- o At the VAB, the Saturn 5 Command Module Launch Escape System separated from the Service Module. Major damage to the Command Module was sustained, and a support request was to be submitted to repair and reposition it.

The LEM at the VIC was picked up and moved to the VAB prior to the hurricane and was returned September 5.

A KSC/NASA exhibit at Walt Disney World Village was dismantled and stored during the hurricane, but was to be opened to the public September 5 through 9. It had been scheduled for viewing from August 31 through September 9. (Notes...Hollinshead[to Center Director], 9-6-79.)

- o As of September 5, the Center received 34 applications for early optional retirement (26 have already been retired). Breakout by organization follows: AM - 15; VO - 4; CO - 2; DE - 4; TS - 7; SF - 1; and CP - 1. (Notes...Malaga[to Center Director], 9-6-79.)
- o On August 29, Bud Campbell, Jerry Jackson and Stan Nelson made a non-committal operations and facilities inspection of Centennial Helicopters, Inc., Orlando, Florida as a possible vendor for cross training two or our fixed wing pilots to helicopters, by furnishing the necessary training for them to obtain a commercial helicopter rating. After this inspection, Bud Campbell and Jerry Jackson continued on to Daytona for a meeting with the aviation section of the Volusia County Sheriff's department which operates two UH-1B helicopters. This meeting was on special tools, equipment, and general provisioning of the UH-1B. (Ibid, p. 2)
- o A TWX to Myron Malkin Deputy Associate Administrator has been prepared with three main points:
  1. KSC & MSFC to develop a mutually acceptable delivery plan for SRBs/SRMs to assure supporting a Nov. 28 Orbiter roll to VAB.
  2. Affirm the Blue Streak ET Ice prevention plan does not impact SRB processing.
  3. JSC/RI to assure the Nov. 28 Orbiter roll to VAB includes close out of all work and paper.

SRM Delivery Plan to be worked included two plans to support the Nov. 28 Orbiter roll to VAB:

Plan A - Use previously agreed to deliveries, i.e., (last SRM Nov. 15) and compress timeline operations by working around the clock.

Plan B - Modify SRM deliveries so that the last SRM arrives earlier than Nov. 15; thus enabling more realistic timeline operation after last segment arrival.

Note: Both plans use the same initial deliveries, e.g. Sept. 20. (Notes...Gray [to Center Director] 9-6-79.)

**September 10:** The processing of a substance which could be used to replace human body tissue and structures will be conducted in a self-contained payload scheduled to be flown in space by the Space Shuttle in 1981.

The substance, collagen, in its natural form makes up some 35 percent of the protein in body tissues and forms the primary structures of tendons, nerves, skin, bones, blood vessels and the cornea of the eye.

Scientists believe that processed collagen could be used to fabricate membranes and prostheses for replacing or repairing human organs, e.g., producing artificial corneas and material for treating burns and replacing blood vessels.

According to Battelle's Columbus Laboratories, which has been developing the experiment, soluble collagen derived from animal tissues can be formed into the desired fibrous, gel-like substance. However, experiments conducted by Battelle at normal gravity "indicate that fibers settle out during their formation, yielding a non-uniform gel."

"But in the weightless environment of space," Battelle says, "collagen processing should yield materials uniform in structure, mechanical strength, refractive index and chemical behavior -- all of which would be desired for biomedical applications. (Defense/Space Business Daily, Vol. 106, No. 4, Monday, September 10, 1979, p. 28.)

**September 11:** International Sun-Earth Explorers (ISEE) -1, 2, and 3 were judged successful based on results of the mission with respect to the pre-launch objectives.

The ISEE Program was an international cooperative effort between the National Aeronautics and Space Administration and the European Space Agency, focusing on solar-terrestrial relationships as a joint contribution to the International Magnetospheric Study. It employed three coordinated spacecraft to advance knowledge of the magnetosphere, the solar wind, and the interactions between them.

ISEE-3 is in a halo orbit about the Sun-Earth libration point, about 1.5 million kilometers from the Earth on the Earth-Sun line. ISEE-3 samples the incoming solar wind one to two hours before it arrives in the Earth's magnetosphere, where its effects are determined in detail by ISEE-1 and -2, moving in similar, highly-eccentric orbits with variable separation. ISEE-1 and -2 are able, for the first time, to separate time and space variations and thus to measure motions and structures as the Earth's magnetosphere responds to the solar wind fluctuations noted by ISEE-3. These studies represent essential steps in understanding the processes that control Earth's near-space environment. ((Mission Operations Report No. 2, MOR No. S-862-77-01/02/03, September 11, 1979.)

10-10-79

**September 13:** Progress towards the first Space Shuttle launch took a step forward here this week with the arrival of the first segment of the vehicle's solid rocket motors.

The segment, some 33 feet long and 12 feet in diameter, arrived September 10 after a month long rail trip from its Utah manufacturer. The segment was stored on a railroad siding container until it will be moved into the Vehicle Assembly Building about September 20th. Once inside it will be unpacked, checked out and prepared for stacking on its mobile launcher.

The Shuttle uses two huge rocket motors, each loaded with some 555 tons of rocket propellant, as well as its three liquid propellant motors at lift-off. The two solid rocket motors are made in segments for ease of transport, to be assembled at KSC in stacks of four each.

The first segment arriving at KSC will be used as the aft segment for the Shuttle's left solid rocket booster. The other seven segments will be shipped as part of regular freight trains at one week intervals, and are expected to arrive at about the same rate. ((NASA News, Release No.: KSC-159-79, September 13, 1979.))

**September 17:** --Two experiments that will be part of the first payload to be carried into space by the Space Shuttle Orbiter Columbia--the Shuttle Imaging Radar Antenna (August) and the Ocean Color Experiment (September)--have been delivered to the Kennedy Space Center. The remaining five experiments are scheduled to arrive here by the second week in October.

Columbia's first payload, called OSTA-1, is made up of seven experiments designed to carry out investigations for Earth resources applications. The payload, under the management of NASA's Office of Space and Terrestrial Applications (OSTA) will fly on the Space Shuttle's second Orbital Flight Test scheduled for launch from KSC.

The first orbital shuttle mission will carry instrumentation to evaluate its performance and will carry a special package called the Induced Environment Contamination Monitor to measure the effects of the Shuttle on the space immediately around it. The IECM will be carried on all six orbital flight test missions.

The payload carried on the second shuttle flight is reusable. This will permit adjustment and modification of the payload instruments and other hardware, to allow its use on subsequent flights at relatively low cost.

Five of OSTA-1's seven experiments will be mounted to an Orbital Flight Test pallet, a 3-meter (10-foot) long, U-shaped structure that fits inside the orbiter's large cargo bay. The other two experiments will be located in Columbia's cabin.

Dr. Jim Ragusa, launch site support manager for the shuttle's first payload mission, said the pallet will be ready for mounting experiments about October 17. Since its arrival last December, the pallet has been housed in KSC's Operations and Checkout Building where technicians are outfitting it with systems for thermal control, electrical power, and for commanding and acquiring data from the experiments.

Designed and assembled by the British Aerospace Corporation for the European Space Agency, as part of the joint ESA/NASA Spacelab program, the pallet is nearly identical to experiment pallets which will be used in Spacelab missions. This is the first of two pallet systems, with the next scheduled to carry physics and astronomy experiments on the fourth shuttle flight.

The first shuttle payload investigations are:

Shuttle Imaging Radar: Uses large 30-by-7-foot antenna to acquire data to evaluate a spaceborne imaging radar for geologic exploration, with particular emphasis on mineral exploration and fault mapping.

Ocean Color Experiment: Designed to evaluate a passive ocean color sensing technique for mapping the concentration of chlorophyll-producing phytoplankton in the open ocean.

Shuttle Multispectral Infrared Radiometer: Will obtain radiometric data from a number of geologic test locations, around the world, in 10 spectral bands.

Measurement of Air Pollution from Satellites: Will measure the variation in carbon monoxide--both natural and man-made--concentration levels in the atmosphere along the orbiter's flight path.

Feature Identification and Location Experiment: Will provide a means of identifying, spectrally classifying, physically locating, and tracking surface features or clouds.

Night/Day Optical Survey of Thunderstorm-Lightning: First attempt to look at lightning from space to develop lightning protection techniques.



Life Science Carry-On Experiment: Will determine the amount of moisture needed for plant/seedling growth in zero gravity. This experiment is the prototype for an experiment to be flown aboard the Spacelab 1 mission. (NASA News, Release No.: KSC-161-79, September 24, 1979.)

**September 20:** NASA announced yesterday that it has been studying two approaches that could be used in space for repair of Space Shuttle Orbiter insulation tiles that may be damaged during the flight into space. The tiles were supposed to remain intact for multiple flights, but problems that have been uncovered this summer, have raised questions about the strength and adhesiveness of the tiles. NASA said yesterday that tile certification has not come up to expectations.

In announcing the study, NASA's Johnson Space Center, expressed "confidence," however, that the tiles will, in fact, withstand the rigors of space and not be damaged; and said that the repair technique is being looked at as a "contingency against flight delays."

Because the first Shuttle flight will only face 70 percent of the aerodynamic pressures to be encountered during the second and third flights, there is a greater chance that repairs will be needed on the later flights.

The two repair approaches are:

- 1) The use of an extendible boom on the Remote Manipulator System to carry a television camera to examine the tiles; and the use of a platform on the boom to transport a space-suited astronaut to the damaged tiles.

- 2) The use of the gas jet Manned Maneuvering Unit backpack to transport an astronaut for inspection and repair of the tiles.

Either method is designed to detect damage as small as four-square inches, the size of the smallest insulation tile.

The repair systems being examined are a spray-on silicon carbide; a cure-in-place epoxy foam; and a pre-cure ablator for bonding in areas with greatest damage. Funded at a total of \$250,000, ten-week studies to design a tile repair kit, have been awarded to General Electric, Martin Marietta and McDonnell Douglas Astronautics.

Johnson Space Center has been conducting studies through September of other tools and equipment that would be needed.

Yesterday's announcement indicated that NASA intended to conduct the first Shuttle flight as an orbital mission; that it has not adopted the JSC proposal to fly sub-orbital to test the tiles. (Defense/Space Business Daily, Vol. 106, No. 13, Friday, September 21, 1979, p. 88.)

- o The Space Industrialization Corp., which had been proposed in legislation sponsored by chairman Don Fuqua (D-Fla.) of the House S&T Committee to promote and fund the development of new products and processes using the space environment, should be founded "only if NASA is unable to attract or support the level of participation to effect a consistent and timely expansion of space industrialization."

This was the position of the Aerospace Industries Association (AIA) as submitted for the record recently, to Fuqua's Space Science and Applications Subcommittee.

The Association endorsed the plan announced this spring by NASA Administrator Frosch, under which NASA would engage in joint arrangements with U.S. companies to promote space industrialization (SI), including providing flight time on the Shuttle at reduced cost and sharing funding of R&D.

"While we cannot say that joint endeavor arrangements with NASA will meet all the needs of companies that want to work in space," it is a good plan and should be "encouraged and expanded where practical," AIA said. "Should these new policies attract more activity than NASA can support, or should they fail to attract adequate industrial participation; then a Space Industrialization Act will be necessary."

The AIA emphasized that the Space Shuttle, the key to the SI program, should be used to strengthen U.S., not foreign industry.

"If we allow other nations to use our Shuttle to gain a substantial head-start in space manufacturing, we may find ourselves in the role of a national trucking service, hauling high technology, space produced components to Earth markets for foreign space industries."

The U.S., it said, should establish its own SI program to exploit its lead in space transportation systems "and protect this nation's previous space technology lead that resulted from Project Apollo." (Ibid, p. 89.)

- o On September 20, 1979, at 1:28 a.m., EDT the High Energy Astronomy Observatory (HEAO-3) was successfully launched by an Atlas-Centaur vehicle (AC-53) into a planned orbit from the Cape Canaveral Air Force Station, PAD LC36B.

The computer orbital parameters achieved by HEAO-3, based on data from various tracking stations are:

<u>Item</u>	<u>Nominal</u>	<u>Actual</u>
Apogee	273.NM	273.8 NM
Perigee	267.3	267.0 NM
Period	94 min	94 min
Inclination	43.6 deg	43.6 deg.
Eccentricity	.000842	.000923

The solar array was deployed prior to separation and the spacecraft has been placed in a housekeeping mode. (Mission Operations Report, MOR No. S-832-79-03. September 20, 1979)

- o The HEAO-C is the third in a series of three Atlas-Centaur launched satellites that are designed to survey the entire sky for X-ray sources and background of about one-millionth of the intensity of the brightest sources; to make measurements of the gamma-ray flux and to determine source locations and line spectra; and to examine the composition and synthesis of cosmic ray nuclei.

The HEAO-C mission performs an all-sky survey of cosmic rays and gamma rays in a manner similar to the HEAO-1 mission, except at a higher orbital inclination. The slowly rotating observatory has the instrumentation generally arranged so that it scans in a direction perpendicular to the axis of rotation, as the Earth revolves around the Sun, provides the full scan, or survey, of the celestial sphere in a 6-month period. Specific scientific objectives of this mission are to: (1) Search for X-ray and gamma ray line emissions in the 0.06 MeV to 10 MeV energy region, and to measure spectrum, intensity, and isotropy of diffuse cosmic X-ray, and gamma ray background; (2) study spectrum, intensity, and temporal fluctuations of discrete cosmic X-ray and gamma ray sources; (3) determine isotopic composition of the most abundant elements from atomic number (Z) from Z=4 (Beryllium) to Z=26 (Iron); and (4) search for super heavy nuclei with charge (Z) greater than 17 thru the trans-uranic elements.

Each of the observatories has a common spacecraft equipment module (SEM) and a mission unique experiment module (EM). The SEM contains all the functional subsystems necessary to operate and control the observatory and experiments.

The SEM and EM are constructed by TRW. The instruments were designed and developed by organizations which include the Jet Propulsion Laboratory (C-1), the Center for Atomic Studies (France, C-2), the Danish Space Research Institute (Denmark, C-2), The University of Minnesota (C-3), Washington University (C-3), and the California Institute of Technology (C-3). (Mission Operation Report, MOR No. S-832-79-03, September 20, 1979.)

- o The first launch of the European Space Agency's primarily French-built Ariane expendable launch vehicle, an announced competitor to the U.S. Space Shuttle, has been rescheduled for December 8 and 18 of this year.

Like the Shuttle, the maiden launch of Ariane had been scheduled for June 1979 and then November 1979. NASA is now hoping to make the first Shuttle flight by June 1980.

The French Space Agency (CNES) will start the "launch campaign" for the December launch on October 1 at the launch base at Kourou, French Guiana.

The Ariane vehicle (L01) left Le Havre, France, by ship for Cayenne, French Guiana, on September 15.

The last qualification test of the Ariane's first stage was successfully conducted September 13 on the test stand of SEP at Vernon, France. The test firing ran for 137 seconds. Main objectives of the final qualification series were: 1) simulation of a month's wait after filling the stage with propellants, including the full amount of the liquid nitrogen tetroxide oxidant for at least a week; 2) simulation of an aborted launch (this was conducted on Sept. 5 and ran for 15 seconds); and 3) burn-out on nitrogen tetroxide depletion. (Defense/Space Business Daily, Vol. 106, No. 12, Thursday, September 20, 1979, p. 83.)

**September 25:** John Yardley, outlined to Congress yesterday a number of evolutionary changes that are being made in the program and later expressed optimism about the two major technical difficulties -- the Space Shuttle Main Engine and the Orbiter insulation tiles.

Asked by Defense/Space Daily after his testimony before the House Space Subcommittee about the outlook of the SSME and insulation tiles, Yardley asserted that both could be ready for a March 1980 maiden flight of the Shuttle; although he stated that the 50/50 chance for the first Shuttle flight now lies between June and August 1980.

He said the SSME which is now installed in the first Shuttle Orbiter is "about the right engine" for 100 percent of rated power; that there are no problems with the engine that remain to be fixed.

[NASA intends to conduct the Shuttle Orbital Flight Tests with engines rated at 100 percent of power, including 100 percent for possible abort. For the first six operational flights, the engines will be rated at 100

percent for flight/109 percent for abort, and after that, 109/109 percent. The 100/109 system would be ready in September 1981; the 109/109 engine, in July 1982.]

Yardley said the heart of the remaining SSME test program is three 5000-second certification cycles with two new engines. Unlike testing which has been done up till now, Yardley emphasized that the engines must now be tested, "as they will fly." For example, he said that six-second pre-launch tests were not done on a similar previous test, but they will be done now.

The problem with the insulation tiles, the NASA associate administrator said, is that the agency is not certain of 100 percent reliability in their certification. That is why NASA will initiate a series of "pull tests" next month to test the strength and adhesion of approximately 10,000 of the 30,000-plus tiles on the Orbiter Columbia.

Yardley estimated that 1 to 5 percent of the tiles tested may prove unacceptable, but said that even at the larger percentage, only 500 tiles would have to be replaced and that that could be done in a week.

He acknowledged that care would have to be taken to avoid damaging the tiles during the tests and reported that NASA is readying an acoustic sensor to determine tile damage.

At the same time, he expressed confidence that once the testing and replacement has been completed, the insulation will do its job on the first Shuttle flight.

There is only "one chance in 1000 that any one tile" will fail, on this flight, he said.

He pointed out that the Orbiter will only be subject to 580 pounds per square foot of aerodynamic pressure on the first flight and that the tiles are being tested at 823 pounds per square foot plus 40 percent. On later flights, the aerodynamic pressure on the Orbiter will increase; and NASA is looking at improved ways to test the tiles and to improve them for these flights, he said.

He acknowledged that if certain of the insulation tiles failed, reentry heat would burn a hole through the Orbiter's skin. That is why NASA feels it is prudent to develop a method of repairing the tiles in space if necessary. (Defense/Space Business Daily, Vol. 106, No. 16, Wednesday, September 26, 1979, pp. 109 & 115.)

- o NASA's planning for the Space Shuttle/Space Transportation System, including the management of the program and its price structure, was given to the House Subcommittee on Space Science & Applications by NASA's associate administrator for space transportation systems, John F. Yardley.

Because STS elements are still in the development stage, NASA is continuing to maintain a heavy Civil Service involvement in day-to-day operations.

"This management concept," Yardley reported, "will be in effect at the beginning of STS operations, but as the system matures the number of Civil Service personnel involved in Shuttle operations should be reduced as will the number of major contracts.

"The period between initial operations and mature operations, which is called the transition period, is currently being examined in some detail. Cross utilization of personnel between production and operations, contract structures, labor relations, Civil Service personnel impacts, skill requirements, and flexibility to deal with uncertainty are all part of this examination."

NASA's planning for the Shuttle era is underpinned by an independent study by the National Academy of Public Administration, which concluded that NASA should retain ownership and management of the STS at least until the mid-1980's, when the ownership matter should be reviewed again.

Another key study, conducted by Booz Allen, has resulted in a planned change in the contract structure at Kennedy Space Center.

KSC is now moving to consolidate most of its contracts into three major contracts: 1) Shuttle operations; 2) cargo processing; and 3) base support.

As the first step, KSC plans to release an RFP to industry by the end of this year for the cargo processing contract, which will include "self sufficiency options."

Yardley said that NASA intends to provide this self-sufficiency option to all contractors "to give them clear responsibilities for total performance. This approach should assure optimum performance particularly if incentives are involved."

Under the new system, a KSC intends to use a spot check and audit system to evaluate contractor performance, a job which may require use of more higher grade personnel.

NASA has also contracted with the McKinsey Corp. for a study, to be completed in December, of the most efficient way to organize the agency's Johnson Space Center during integrated STS operations, including determining the institutional impact of transferring functions from Civil Service to contractor personnel.

Yardley said that NASA intends to maintain the option to choose "the management approach best suited to operation of the national STS. Positive action is being taken at KSC on what we believe to be a firm and complete analysis, but we are still maintaining options at KSC as well as at Johnson Space Center, Marshall Space Flight Center and Goddard Space Flight Center." (Defense/Space Business Daily, Vol. 106, No. 117, Thursday, September 27, 1979, p. 120.)

**September 27:** The first Ariane flight vehicle arrived in French Guiana September 25. It will be erected on the launch pad at Kourou next week, October 1. Launch is scheduled for December 8. Tracking and data support to be provided to the French project includes the Ascension STDN station (GSFC), the ETR Ascension station, the ETR Cyber computers and Tel IV. A series of network checkout testing is scheduled for October 9-16. TS-NTS has been actively involved in the requirements generation and will participate in the testing. Other developmental launch dates are presently scheduled for March 15, June 15, and October 1980. (Notes...Minderman [to Center Director], 9-27-79.)

- o NASA-Johnson has awarded a \$9.6 million modification to Rockwell International's Space Division for a number of previously approved work proposals, including acoustic testing of a quarter scale model of the Shuttle Orbiter. The contract brings Rockwell's Shuttle contract to \$3.5 billion. (Defense/Space Business Daily, Vol. 106, No. 19, Monday, October 1, 1979 p. 134.)
- o The House Thursday approved the FY '80 HUD-IA appropriations bill, which included \$4,983.5 million for NASA, \$6.5 million below the Administration's request.

To resolve a difference with the Senate, chairman Edward P. Boland (D-Mass.) of the HUD-IA Subcommittee agreed to add \$23 million to the R&D portion of the bill originally voted by the House to bring it up to the Senate level. The Senate earlier restored most of the cuts made by the House and added \$17 million for the VCE, MSS, NOSS, rotorcraft and energy.

But Boland included language that the \$23 million be earmarked as a reserve for the Space Shuttle only, asserting that the Shuttle would need another \$200 million to \$300 million in FY '80 above the amount already requested.

Sen. Charles McC. Mathias (R-Md.), the man who pushed through the additions, was expected to argue for those additions, Friday, but might agree to a compromise figure.

Boland also included language to require NASA to get approval of his committee before it awards contracts changing the Galileo Jupiter Orbiter/Probe to a dual mission, as is now expected. The dual mission would add \$225 million to the cost. Mathias is also expected to object to that provision, although it had been accepted by Rep. Don Fuqua (D-Fla.) chairman of the House Science & Technology Committee and is backed by chairman William Proxmire (D-Wis.) of the Senate HUD-IA Committee. (Ibid, p. 138.)

**September 28:** Approval of the \$72 billion HUD-IA appropriations bill, including about \$4.94 billion for NASA, was stalled in the Senate Friday when Sen. Charles McC. Mathias (R-Md.) engineered a 49 to 20 rejection of a House provision requiring NASA to come to Congress for approval, before changing the Galileo Jupiter Orbiter/Probe mission to a dual mission.

Mathias coupled this objection to a \$13 million cut in \$23 million in NASA R&D funds that were originally cut by the House and restored by the Senate, which the House Thursday agreed to restore. The House, however, provided that the restored funds could be used only as a contingency for the Space Shuttle, which it said would need another \$200 to \$300 million in FY 80. Mathias rejected that idea, and instead asked that \$10 million of the funds be provided for the Multi-Spectral Scanner, rotorcraft R&D and the Variable Cycle Engine, with \$13 million cut as "an economy" measure.

With Republicans voting 29 to 1 for the Mathias amendment, and Democrats about evenly divided, the measure carried.

The Senate version of the HUD-IA bill had been sent back to the House, which had recessed until Monday. If the House agrees to the NASA provision, which is not expected, the bill could be sent to the White House. If not, it is back to conference. In the meantime, the Senate had prepared a continuing resolution which would temporarily fund NASA in FY '80 at the lower [House] pre-conference level of \$4.91 billion. ((Defense/Space Business Daily, Vol. 106, NO. 20, Tuesday, October 2, 1979, p. 141.))



- o Countries, government agencies or companies who pay for a dedicated Spacelab mission on the Space Shuttle may provide two of their own payload specialist-astronauts for the mission. NASA will make medical/psychological tests of the payload specialist candidates and train them in emergency and other necessary procedures. Users who pay for half of the Spacelab's payload will be allowed to provide one payload specialist.

Four types of Spacelab flights, with differing costs, will be offered to users:

1) Dedicated Shuttle Spacelab Flight -- Full Shuttle flown for a single Spacelab user.

2) Dedicated Element Flight -- A partial Spacelab flown for a single user and which includes all Spacelab hardware for autonomy.

3) Complete Pallet Flight -- A complete Spacelab pallet flown for a single user but which flies with other Spacelab elements on a NASA Spacelab flight and shares common services.

4) Shared Element Flight -- A pallet or pressurized module which is shared by two or more users on a NASA Spacelab flight and which shares services with other Spacelab elements on the same flight. (Defense/Space Business Daily, Vol. 106, No. 18, Friday, September 28, 1979, p. 126.)

- o An independent study panel has recommended that NASA retain ownership and control of the Space Transportation System (STS) at least through the mid-1980's; rather than turning it over to private or mixed ownership or to an existing or new federal department. At that time, the ownership question can be reevaluated, it said.

The study was conducted by a seven-man panel, chaired by James M. Beggs, executive vice president of General Dynamics Corp., which was convened by the National Academy of Public Administration at NASA's request.

Beggs told the House Subcommittee on Space Science & Applications Tuesday that economics rules out private or mixed ownership of the STS "at least through the 1980's.

"To attract private capital sufficient to establish a viable corporation, would require user charges much higher than that required to establish a market," he said. "In fact, it would probably preclude usage by any except the government, thus the government would be fully subsidizing the corporation. However, after suitable experience, and if commercial usage truly flourished, private investment in the system would indeed become financially feasible and should be reconsidered at that time."

There has to be a "testing of price against the market" before it would be viable for corporate operation of the STS, he told the subcommittee.

Private operation of the STS would require a capitalization of several hundred million dollars plus some funds for operations together with a subsidy from the Government for its payloads, he said.

Under questioning, Beggs said that his panel did not find anyone who was interested in making this kind of investment, and was told by the New York investment community that there was not enough investment capital available for such an undertaking.

As for government operation of the STS, the panel concluded that NASA, DOT and a new agency were the only viable alternatives, and that among them, NASA is clearly the best choice.

It concluded that there is "a marked difference in expected performance depending upon whether the STS organization and NASA were joined or separated. When joined, they reinforced and complemented one another; when separated, it...raised the potential of conflict and competition for both funds and support."

As to whether the STS organization should be a component of NASA or a government corporation within NASA, the panel noted that NASA already has most of the flexibility of operations that is the typical advantage of a government corporation; while such a corporation would have to meet financial reporting requirements which "would add an undue burden which...is unwarranted and perhaps harmful during the initial period of Shuttle operations."

However, "the day may come when a corporate form would be advantageous and should be studied at a later date, if and when commercial use of the Shuttle has developed beyond current projections," Beggs said. "In the meantime, the STS organization should take the form of a NASA component."

The panel further recommended that NASA comprise STS operational management so as not to divert the agency's management attention from R&D. (Ibid, p. 127.)

- o Satellite Business System, which is anxious to have its two domestic satcoms launched by the Space Shuttle for both cost and operational reasons, now expects to pull its first satellite off the Shuttle because of program delay; but is hoping to launch its second satellite on the Shuttle.

SBS Vice President William D. English said that because the launch of the first company satcom had been rescheduled from July 1980 to the fourth quarter of 1981, SBS "will in all likelihood have to exercise its Delta rocket back-up option for the first launch in order to begin operations, as scheduled, January 1981."

This will result in a \$15 million cost increase for the company -- the difference between the \$22 million October 1980 cost for the McDonnell Douglas Delta and the estimated \$7 million costs for a Shuttle launch -- and a resultant increase in satcom tariff.

Another disadvantage, English noted, is that the Shuttle can provide several launch opportunities during its multi-day stay in space which provides "a higher probability of a successful deployment" of the payload.

English said that SBS still hopes to launch its second satellite, an in-orbit backup, on the Shuttle, but admitted that any further slip in the Shuttle schedule would require the company either to delay its second satellite or to contract for a Delta launch.

At the same time, English told the House Space Science & Applications Subcommittee that he would like to see NASA maintain the Delta program, at least until two Shuttle Orbiters are operational, to provide a guarantee of a launch capability in the event that the first Orbiter malfunctions.

In such a case, as it now stands, he suggested, SBS and others would have to turn to the European Ariane launch vehicle [scheduled for its maiden flight in December].

On another Shuttle related area, English expressed general satisfaction with NASA's satellite liability procedure, under which the agency is requiring private Shuttle users to obtain a maximum of \$500 million in commercial third party liability coverage, naming the U.S. Government as an insured party. In return, NASA agrees to indemnify users for any third party liability above that insurance coverage. If a user cannot obtain adequate liability insurance, NASA may provide the user with insurance and/or indemnity to cover the user's exposure. English said that this provision is mandatory if private risk capital is to be available to finance high technology satellite ventures. (Ibid, p. 130.)

- o During September a milestone in Space Shuttle progress was reached with the transfer of the first flight-configured solid rocket booster aft skirts from Marshall Space Flight Center's jurisdiction to that of KSC; and their subsequent mating with the first SRB motor segment to arrive by rail from Utah.

Two aft skirts support the entire 45.4-meter (150-foot), 3.7-meter (12-foot) diameter boosters, in turn supporting the external tank and Orbiter Columbia on the mobile launcher platform. The aft skirts also contain the Thrust Vector Control system, the steering mechanism for the solid boosters.

The right-hand aft skirt was moved September 24 from VAB's low bay (where thermal insulation build-up and a detailed automatic checkout of the two SRB assemblies were performed) across the transfer aisle into High Bay . Then on September 25, it was mated with the right aft solid motor segment. That same day, the left hand aft skirt was moved to High Bay 4, and mating of that component with its respective motor segment was scheduled for today. (Spaceport News, Vol. 18, No. 21, John F. Kennedy Space Center, September 28, 1979, p. 1.)

- o Following about six months of painstaking checkout activities, Columbia's Forward Reaction Control System was reinstalled. Shortly after Columbia's arrival at KSC, the forward RCS module was removed and placed in a checkout cell in the Hypergolic Maintenance Facility for initial processing. The forward module, along with two similar pods at the orbiter's aft end, will steer Columbia during various phases of orbital flight. (Ibid.)

October 1979

October 1: Precision Fabricating & Cleaning, Inc. of Sharpes, Florida has won a supplemental agreement to an existing contract with NASA's John F. Kennedy Space Center. The agreement is for \$549,715, bringing the cumulative value of the contract to \$2,535,015.

The agreement is for the period from October 1, 1979, through September 30, 1980. During this period, the firm will provide refurbishment and retest of government-owned compressed gas trailers.

The trailers are used for temporary storage and transfer of highly compressed gases to various facilities throughout Kennedy Space Center. The gases are used in many kinds of ground equipment as well as launch vehicles, including the Space Shuttle. (NASA News, Release No. KSC-184-79, October 29, 1979)

- o NASA is beginning to accept applications for Space Shuttle astronauts on an annual basis. This year, the period for submitting applications by civilians began Oct. 1 and ends Dec. 1.

Those chosen as applicants will be assigned to the astronaut office and placed in responsible technical or scientific positions where they will receive assignments to the Space Shuttle Program and continue work in their scientific or technical fields, where practicable.

Pilot astronauts will control the Space Shuttle during launch, orbital maneuvers and landings and will be responsible for maintaining vehicle systems. Mission specialist astronauts will have responsibility for the coordination (with the commander and pilot) of Shuttle operations in areas of crew activity planning, use of consumables and other Shuttle activities affecting experiment operations. Mission specialists will continue in their chosen fields of research and will be able to propose, develop and conduct space experiments.

Pilot applicants must have a bachelor's degree from an accredited institution in engineering, biological or physical science or mathematics.

They must have at least 1,000 hours of "pilot-in-command" time in high performance jet aircraft, must pass a NASA spaceflight physical and be between 162 and 193 centimeters tall.

Mission specialist applicants, while not required to be pilots, must meet the same educational requirements and have at least three years of similar experience. An advanced degree may be substituted for experience. Mission specialist applicants must pass a NASA spaceflight physical examination and be between 152 and 193 cm. tall. (NASA Activities, Vol 10, No. 10, October, 1979, p.7)

- o Aerospace Services Division, of Cocoa Beach, Fla., has been selected by the Johnson Space Center for negotiations leading to the award of a cost-plus-award-fee contract for engineering support services. The contract, valued at some \$1.3 million, covers engineering design support for facilities and test programs at JSC. (Ibid, p.16)

**October 3:** The Galileo Jupiter mission, previously planned as a combined mission in January 1982 has now been proposed as two separate flights in January 1984; as the Shuttle will not be capable of carrying the weight of the combined mission.

In getting House approval for language prohibiting NASA from awarding new contracts for hardware development of separate orbiter and probe spacecraft, Rep. Edward P. Boland (D-Mass.) said that an option to be carefully considered is to launch the orbiter and delay the probe until 1988.

NASA's recommended two flights in 1984, according to Boland, would result in a \$225 million or 75 percent overrun. (Defense/Space Business Daily, Vol 106, No. 21, Wednesday, October 3, 1979, p.150)

**October 4:** The successful argument used by Sen. Charles McC. Mathias (R-Md.) to get the Senate to oppose the action by the House Appropriations Committee to give itself a veto over the Galileo Jupiter Orbiter/Probe and to place \$23 million in "reserve" for the Shuttle, involved the question of jurisdiction between the authorizing and appropriating committees in Congress.

If the appropriations committees are allowed to kill the Galileo project at this point, Mathias said, the authorizing committees "are completely shut out of the game on that procedure." He pointed out that there is no need for the appropriations committees to have special authority over Galileo, since "Congress has all the safeguards it needs to insure that it will be fully consulted during any change in the program."

As for the proposal for a \$23 million "reserve" for the Shuttle, Mathias said that such a fund has not been authorized and therefore there is no authority to create it.

As part of his amendment, Mathias called for deleting \$10 million of the \$23 million in question -- cutting the NASA R&D appropriation to \$3,809.5 million -- and employing the remaining \$10 million for new projects. Under the amendment, the following projects would get the following minimum funding:

- \*Space Shuttle Thrust Augmentation -- \$1.5 million (\$15 million requested).
- \*Multi-Spectral Resources Sampler -- \$2 million (nothing requested).
- \*Advanced Rotocraft Technology -- \$5 million (nothing requested).
- \*Variable Cycle Engine -- \$8 million (\$5 million requested).

Mathias carried the day when he was supported by Sen. Howard Cannon (D-Nev.), chairman of the Commerce Committee, which is responsible for the NASA authorization, and by Sen. Adlai E. Stevenson (D-Ill.), chairman of the committee's Space Subcommittee.

Among other things, Cannon reported that NASA "would find it difficult to live with" the veto provision approved by the House; that about \$100 million has been spent to date on Galileo, and that NASA had not yet made a decision to split the Galileo into two missions.

Sen. William Proxmire (D-Wis.) arguing that the Mathias amendment was false economy, said that two of the new projects included would add \$73 million to the NASA budget -- the Multi Spectral Resources Sampler (runout of \$24 million) and Advanced Rotocraft Technology (runout of \$49 million).

The 20 senators who opposed the Mathias amendment (adopted 49-20) are Baucus, Boren, Bradley, Burdick, Harry Byrd, Robert Byrd, Culver, Eagleton, Inouye, Levin, Magnuson, Matsunaga, Moynihan, Muskie, Pell, Pressler, Proxmire, Pryor, Sasser and Tsongas. (Defense/Space Business Daily, Vol 106, No. 22, Thursday, October 4, 1979, p.156)

- o A preliminary revised working schedule is being used for OPF processing. The new Orbiter rollout date is December 21 (was November 24). The July 11 official STS-1 schedule provided four weeks contingency time in the OPF which is now planned work. Therefore, the success-oriented March 31, 1980, launch date for STS-1 is still possible. Critical path processing includes internal manufacturing, modifications, and retesting. The VAB and Pad schedules have not changed except for External Tank and Solid Rocket Booster processing which now is compatible with the orbiter. A new official

STS-1 processing schedule is under review and expected to be published in early October. (Notes...Gray [to Center Director], 10/4/79 p.5)

- o A Thermal Protection System In-flight Repair meeting was held at JSC on September 27 with Mr. Yardley. The decision was made to fix the TPS problem first and, as an option, to fly the MMU. Also, the contract for the stabilized TV system was extended for another month to determine the cost and the impact of the TV system if flown with the Manned Maneuvering Unit. All effort to fly the RMS/ITRS system on Flight STS-1 was terminated. (Ibid, p.6)

October 5: NASA has concluded that it will not need to inspect in space, and possibly repair, the insulation tiles on the Space Shuttle Orbiter on its maiden flight, which is scheduled for June 1980.

"Inspection and repair of tiles should not be required on the first Shuttle orbital flight, designed to cause lower than normal stress, because the tiles will have been proof tested through the full range of stress expected in normal operational flight," the agency said.

The major part of the proof testing, involving "pull" tests of some 10,000 tiles on the Orbiter Columbia at Kennedy Space Center [with strength monitored acoustically] began Tuesday. Aerodynamic tests of the tiles installed on aircraft are scheduled to begin at Dryden as soon as the tiles are delivered, and wind tunnel tests are planned starting next month at the Arnold Engineering Development Center.

According to NASA Associate Administrator John Yardley, there is only "one chance in 100 that any one tile" will fail on the maiden flight.

At the same time, NASA has directed Martin Marietta to speed development of the Manned Maneuvering Unit, which will be used by Shuttle astronauts on later flights to inspect the tiles and repair them if necessary, using a repair system being designed competitively by Martin, General Electric and McDonnell. Goal is to have the MMU ready by August 1980.

In selecting the MMU, NASA dropped consideration of an alternate plan to use a boom extended from the Remote Manipulator to carry a television inspection system and to transport an astronaut for the repair effort. As another option, NASA says it will study for another month the possibility of a free-flying television system for the tile inspection, with the Orbiter maneuvering around the system. (Defense/Space Business Daily, Vol. 106, No. 23, Friday, October 5, 1979, p.161)



- o STS-1 Schedule. The revised STS-1 Official Schedule was published on October 5 and was distributed. OPF rollout is now December 21. Launch date remains March 31, 1980. The Management Presentation Summary Chart for STS-1 has been updated and is attached to it. Copies of the new official schedule and the STS-1 summary charts have been sent to Bill Land/NASA Headquarters, to be used for a presentation to the Administrator, October 15.

The Program Manager approved the baselined OFT launch schedule with the following:

STS-1	March 31, 1980 to June 30, 1980
STS-2	November 4, 1980
STS-3	February 27, 1981
STS-4	May 19, 1981
STS-5 (FOF)	September 30, 1981

(Notes...Gray [to Center Director], 10/11/79)

**October 11:** In a move to give Associate Administrator John Yardley more time to work on the development problems of the Space Shuttle, NASA has divided its Space Transportation System Office into an Office of Space Transportation System Acquisition, to be headed by Yardley, and an Office of Space Transportation System Operations, to be headed by a new associate administrator to be named.

The user-oriented STS Operations Office will be responsible for scheduling, manifesting, pricing, launch service agreements, Spacelab, expendable Launch vehicles, and primary interface with STS users.

The realignment was presaged by the recent creation within the STS Office of a separate operations organization under by a newly created deputy administrator position. Charles R. Gunn, who had headed the Landsat-D project at Goddard Space Flight Center, was named to the operations post. (Defense/Space Business Daily, Vol 106, No. 16, Thursday, October 11, 1979, p.185)

**October 12:** NASA's John F. Kennedy Space Center has awarded a \$138,627 contract to Industrial Steel, Inc., of Mims, Fla., for construction and modifications to Launch Complex 39's Pad A.

Under the contract, Industrial Steel will complete various modifications to the Fixed Service Structure, the 247-foot-tall steel tower which provides access to the Space Shuttle orbiter at the pad. Alterations will be made to various platforms on the structure, and a steel sling will be made to support the Emergency Exit System, which will remove personnel from the orbiter and Fixed Service Structure in case of an emergency.

The contract is one of those set aside for a small business firm in an area with a high unemployment rate. The work under the contract is to be completed by December 15, 1979. (NASA News, Release No: KSC 179-79, October 12, 1979)

**October 17:** Because the Space Shuttle/Inertial Upper Stage will not have the required thrust to conduct the Galileo Jupiter Orbiter/Probe mission in 1982 as planned, NASA has chosen to split the mission into a separate Orbiter and Probe to be launched by two Space Shuttle/IUS's in 1984, according to NASA's new associate administrator for space science, Dr. Thomas A. Mutch.

Mutch told the House Subcommittee on Space Science & Applications that the NASA action, assuming it is approved by Congress, will boost the cost of the mission by an estimated \$184 million plus the added cost of a second Shuttle launch.

He said the cost of developing and operating the spacecraft will increase by \$153 million over the estimated \$450 million for the joint 1982 mission, and that the cost of procuring the Inertial Upper Stage systems will increase by \$31 million over the original \$23 million. He put the overall cost increase at 39 percent.

Meanwhile, on Tuesday, NASA advised its authorizing and appropriating committees in Congress that, after its FY '80 appropriations bill is passed -- and it is stalled over the revised Galileo program -- it will submit the revised program as a reprogramming, including a description of the revisions to the program and the budget impact, which will give Congress the opportunity to decide if it wants to support the revised effort.

Asked by chairman Don Fuqua (D-Fla.) whether it would be more cost effective to cancel Galileo and use the funds for other missions, Mutch noted that that would only result in a loss of \$160 million on the program -- \$100 million that has already been spent plus another \$60 million in close-out costs. He termed the NASA action as the most cost effective course. Mutch noted that the science for the mission would be improved slightly by having the probe on a separate dedicated carrier.

Asked by Fuqua if the Probe mission could be delayed to 1985 or later, Mutch said that NASA had not looked closely at that, but estimated that it

might boost the cost of the mission by \$20-\$30 million over the \$120 million estimate and cause a problem in retaining the contractor (Hughes). He also cited the advantage of mission simultaneity but said that might be achieved even with a one-year delay.

At the same time, the NASA associate administrator reported that the weight of the Galileo Orbiter comes close to the expected capability of the Shuttle/IUS in 1984, but termed the margin "comfortable."

Asked by Fuqua if the IUS is sufficient for the planetary missions planned by NASA, Mutch said it is, provided that it is coupled with the Solar Electric Propulsion System (SEPS) which is in development, although the margin is not great. Planetary missions planned, he said, include the Venus Orbiting Imaging Radar (VOIR), Halley's/Tempel 2 comet mission, and a Saturn Orbiter Dual Probe.

In his first appearance before the subcommittee, Mutch conveyed the same enthusiasm for NASA's space science program which had been exhibited by his predecessor, Dr. Noel Hinners, and which has been an important part of garnering support for the program. At the same time, he acknowledged that space science faces funding problems.

"Though I am excited by the number of opportunities we have to extend our scientific knowledge in space," he said, "I am also sobered by the realization that financial constraints may cause us to make difficult selections between many worthy new projects in our plan."

--International Solar Polar Mission. There are no cost problems on the program and from the U. S. point of view there is no problem in meeting the planned February 1983 launch window. NASA believes that it will have a comfortable weight margin for the mission using a Space Shuttle and three-stage IUS. However, if the Shuttle thrust capability does not grow as anticipated, the mission could be conducted on two separate Shuttle launches. This is considered an "attractive backup with no major problems involved."

--Infrared Astronomical Satellite. NASA has experienced a number of technical problems in development of this international satellite, largely due to the requirement to have the telescope operate at -270 degrees C. These technological difficulties have resulted in a six-month slip in the projected launch date to August 1981 and an increase in the runout cost of the U.S. portion of the project from \$37 million to \$53 million.

--Space Telescope. The project is on schedule and within cost, although NASA has had to dip into the reserves established for the program. The reserves are considered "adequate." NASA has established a committee to keep a close watch on this project and believes it will be completed on schedule

and within cost. Mutch said he knows of no technical "showstoppers" on the project. The polishing of a 60-inch test mirror has been successfully completed by Perkin-Elmer and the 96-inch primary mirror for the telescope is currently being shaped and figured by manually-controlled machines. Computer-controlled polishing is slated to begin in February. Eastman Kodak has started grinding operations on a 96-inch backup mirror blank. RFP's for operation of the Space Telescope Science Institute are planned for release next month.

--Gamma Ray Observatory. Studies of the spacecraft have been completed by NASA-Goddard and NASA is ready to proceed on the spacecraft, which will be the first in a planned series of new high energy missions. NASA wants the GRO as an FY '81 new start but needs OMB approval.

--New Explorers. Detailed studies are continuing on the Cosmic Background Explorer (COBE), which will measure the residual microwave background radiation believed associated with the "Big Bang" origin of the universe, and the Extreme Ultraviolet Explorer (EUVE), which will survey the sky to study very hot objects.

--Advanced X-Ray Astrophysical Facility (AXAF). Studies have been started on this mission, which will provide "the next major step in x-ray astronomy" after HEAO-2.

--Gravity Probe-B. Studies are continuing on this spacecraft, an orbiting gyroscope experiment to test the theory of General Relativity.

--Origins of Plasmas In the Earth's Neighborhood. Definition studies are being conducted on this mission, which will be the first to study the geospace environment as a whole. OPEN will have four instrumented spacecraft, to be placed in different orbits within the solar wind and regions of the Earth's magnetosphere and geomagnetic tail. The spacecraft will have orbit adjust capability. An Announcement of Opportunity soliciting investigations for the OPEN mission will be released soon.

--Solar Probe. Studies are underway for the definition and technology development of this mission, which is planned for the late 1980's to explore the innermost parts of the solar wind, passing within three solar radii of the Sun's surface. (Defense/Space Business Daily, Vol 106, No. 31, Thursday, October 18, 1979, p.221,225)

- o NASA the Department of Energy (DOE) are continuing their studies of the possibility disposing of nuclear wastes in space via the Space Shuttle, with work to date continuing to indicate that the concept "is feasible" and that there are no "major technological impediments." This report was made Tuesday by NASA energy chief Donald A. Beattie.

As a result of studies to date, a mission profile has been defined using the Shuttle and two chemically powered, recoverable Orbit Transfer Vehicles to place the nuclear wastes in a solar orbit "halfway" between the orbits of Earth and Venus (0.85 AU).

NASA and DOE are now defining systems and operations concepts to handle the waste from the time it leaves the reactor until it is deposited at a space destination, and examining the major technology development requirements and engineering problems associated with safety, environmental concerns and preparation of the waste. (Ibid, p.224)

- o President Carter has been told by NASA Administrator Frosch that there are no serious unsolvable technical problems remaining on the Space Shuttle and that the agency is placing more attention on management of the program to ensure its success.

In his report to the President, Frosch did not elaborate on the Shuttle's tile insulation and engine problems; discuss the launch schedule for the program, or estimate how much additional funding would be required for the Shuttle in FY '80 and beyond.

He told the President that a "revised program financial operating baseline is being developed" this month and will be presented as part of the FY '81 budget process. [NASA is expected to request an additional \$200-\$300 million for the Shuttle in FY '80.]

A reexamination of the Shuttle program by NASA and outside specialists has concluded that the program "appears to be fundamentally technically healthy," Frosch wrote the President. "While there are problems to be solved and many unknowns still to be faced there are no currently known serious problems that we do not know how to solve."

The NASA chief cautioned the President, however, "that an element of risk always exists in space flight operations."

Frosch attributed the budget problems on the Shuttle to the fact that the program "was underfunded at the start and. . . has been underfunded since. This was sufficient to force an overly lean program with management consequences: a short-term management attitude of solving problems as they arise while putting off long-term large-scale planning," he said. (Ibid, p.226)

October 18: NASA Administrator Robert Frosch estimated that DDT&E costs of the Space Shuttle have risen to \$6.115 billion in FY '71 dollars, an increase of 18.5 percent over the \$5.15 billion estimate made a decade ago, and an escalation of \$460 million since the beginning of the year.

He reported to the House Subcommittee on Space Science & Applications that the estimated cost of building the remaining three Space Shuttle orbiters, based on what NASA has "learned about the difficulties of assembling and testing an Orbiter flight vehicle," has increased 20 percent since January.

Frosch stated that as a result of problems in developing the Shuttle, NASA will require more funds for the program in FY '80 and in future years for the program than it previously estimated.

He said that NASA will submit an FY '80 supplemental request for "several hundred million dollars" along with its FY '80 budget request in January, adding that Congress would have to approve those supplemental funds by the end of June in order for them to be properly used.

NASA Comptroller William Lilly reported that NASA would request \$550 million in FY '81 for DDT&E of the Shuttle. NASA had estimated these costs at between \$500 and \$550 million in January, he said.

Frosch told the subcommittee that NASA is working toward the first flight of the Shuttle in April 1980, but that is more likely that the flight will take place in the mid to late summer. The chances for Shuttle launch, he said, are:

- \* 10 percent by April
- \* 50 percent by July
- \* 80-90 percent by September.

He said flight go-ahead will depend solely on the readiness of the Shuttle: "It will not fly before it is ready to fly."

The pacing item in the maiden Shuttle flight, he said, is the thermal insulation tiles, which are currently undergoing adhesion tests and replacement if found to be inadequate.

Because of the time required for the tile effort, he said, "we expect the Orbiter (Columbia) to leave the processing facility in January or February, and we can look to a first flight readiness firing on the pad in the spring. If we do not have to bring the Shuttle back to the Vertical Assembly Building (VAB) for further checkout, we could have a first flight by mid-year."

At the same time, NASA has revised its delivery schedule for the three additional Orbiters as follows: Second Orbiter, June 1982, Third Orbiter, September 1983, and Fourth Orbiter, December 1984.

Frosch reported that over 9600 thermal protection system tiles have been installed on the Columbia since its arrival at Cape Canaveral, leaving about 2100 to go -- plus the replacement of those already-installed tiles which are found inadequate.

Frosch said that NASA will pull test all of the 20,000 critical black tiles on the Columbia plus some of the other tiles which are in less critical positions.

NASA Associate Administrator John Yardley reported the sobering news that since the pull-tests began this month, 7 percent of the tiles examined on Columbia have failed testing and will have to be replaced. He said that 2 percent actually came off the Orbiter and 5 percent exhibited noises that indicated that they would fail. He said NASA expects to pull-test 3000-4000 tiles per week. Frosch said that NASA is "prepared to have one or two thousand tiles that will require rework."

He said that NASA only became aware of the potential tile failure problem about six months ago.

"Why it was not found earlier, I don't know," he said.

He said that most people who have looked at the insulation problem have concluded that there must be a better way, but so far no one has found it. However, he said that NASA had developed a second generation tile with much greater strength, which it hopes to use on the second Orbiter if it can be certified in time.

Frosch noted that the insulation tiles are an important part of the reusability of the Shuttle, but acknowledged that it remains to be seen if the tiles are as reusable as planned. (Defense/Space Business Daily, Vol. 106, No. 32, Friday, October 19, 1979, pp.230,231)

**October 22-24:** The Spacelab 2 Investigator Working Group, consisting of about 75 scientists and engineers selected to participate in the second Spacelab mission, met at the Kennedy Space Center October 22-24.

Thirteen investigations will be flown on the Spacelab 2 mission, emphasizing astronomy, high energy astrophysics and solar physics research. Experiments will also be performed in plasma physics, botany and medicine.

Spacelab 2 is scheduled to be launched from KSC on the Shuttle's 14th flight, operate in space for seven to 12 days, and land at KSC's Shuttle Landing Facility. The Investigator Working Group consists of scientists serving as principal investigators for the experiments to be conducted during the mission, and NASA mission planners and design engineers.

Of the 13 investigations planned for Spacelab 2, 11 originate in the United States and 2 in the United Kingdom, resulting in the involvement of 47 scientists from across the country, and 12 from the U.K. The group was chosen from more than 1,000 candidates who responded to invitations to participate in the mission. (NASA Activities, Vol. 10, No. 12, December, 1979, p.5)

- o The Pegasus 2 spacecraft assembly, launched by NASA in 1965, reentered the Earth's atmosphere on Nov. 3, according to the North American Air Defense Command. The command compiles information on satellite payloads, rocket bodies and other orbiting pieces that could survive the friction and heat of reentry and impact on Earth.

Pegasus 2, launched May 25, 1965, was used to gather micrometeoroid data for use in the design of spacecraft. It was one of three such spacecraft, all launched in 1965. Pegasus 1 reentered Sept. 17, 1978, over Africa and Pegasus 3 reentered Aug. 4, 1969, over the Pacific Ocean.

The Pegasus assembly weighed about 10,430 kilograms and was 21 meters long. The spacecraft itself weighed about 1,450 kg. It was attached to the empty S-IV stage and the instrument unit of the Saturn 1 launch vehicle. None of the sections had any radioactive nuclear power sources or materials aboard.

It is estimated that approximately 9,705 kg of orbital hardware was destroyed by reentry heating. Such a breakup of reentering spacecraft is normal and has not, in the history of space flight, resulted in personal or property damage on Earth. No surviving pieces of Pegasus 1 or 3 were found or recovered. (Ibid, p.9)

**October 26:** The House and Senate have agreed to a \$4.93 billion FY '80 appropriations for NASA and sent the measure to the White House as part of the \$72 billion HUD-1A appropriations bill.

To end the impasse of the NASA bill, the House agreed to drop its language that would have required NASA to come to the appropriations committees before proceeding with the modified Galileo Jupiter Orbiter/Probe mission.



NASA recently agreed to submit the revised program as a reprogramming, which will allow Congress to evaluate it.

The House also agreed to drop its "compromise" proposal that \$23 million in R&D funds restored by the Senate be put into a reserve for the Space Shuttle. The Senate, after that House action, decided to pare the restoral to \$10 million. The bill sent to the White House cuts that to \$8 million -- \$5 million for Advanced Rotocraft Technology and an additional \$3 million for the Variable Cycle Engine. Cut was \$2 million proposed to initiate the Multi-Spectral Scanner. (Defense/Space Business Daily, Vol. 106, No. 37, Friday, October 26, 1979, p.269)

October 29: The FY '80 appropriation for NASA approved by Congress last week totals \$4,923.5 million and compares with the amount requested and last year's appropriation as follows:

(in millions of dollars)

	FY '80	Requested	FY '79
Research & Development	\$3,807,500	\$3,822,500	\$3,477,200
Construction of Facilities	156,100	157,600	147,500
Research & Program Management	959,900	964,900	936,469
Total	\$4,923,500	\$4,945,000	\$4,581,169

The FY '80 NASA appropriation is \$13 million above the amount originally approved by the House and \$20 million below the amount originally adopted by the Senate.

The \$15 million reduction in R&D comes from a deletion of the \$15 million requested for the Shuttle Thrust Augmentation System, a cut of \$5 million in Space Flight Operations and a \$3 million reduction in computer acquisitions, offset by a \$5 million increase in Rotorcraft Technology and a \$3 million increase for the Variable Cycle Engine.

However, NASA will be able to continue design work on the thrust Augmentation System as well as to conduct computer acquisitions if it so chooses with available funds, if it informs Congress of such moves. (Defense/Space Business Daily, Vol. 106, No. 38, Monday, October 29, 1979, p.273)

- o The first two items of hardware developed by NASA Marshall to fly in the Space Shuttle Orbiter cargo bay have been delivered to Kennedy Space Center. The items are an induced Environment Contamination Monitor, which contains ten instruments to check for experiment-affecting contaminants in the cargo bay, and a Release Mechanism, which will hold down the

contamination monitor, release it when required and then resecure it.  
(Ibid, p.277)

- o During October: A new Headquarters program office has been established to be responsible for operations of the Space Transportation System, NASA Administrator Dr. Robert A. Frosch announced this week.

The new office, headed by an Associate Administrator to be named soon, will have charge of Space Transportation System operations and functions including scheduling, manifesting, pricing and launch service agreements, the Spacelab program, and NASA's expendable launch vehicles, except for development of Space Shuttle upper stages. The new office will be the principal interface with all STS users.

The Office of Space Transportation Systems is being renamed the Office of Space Transportation System Acquisition.

John F. Yardley, presently NASA's Associate Administrator for Space Transportation Systems, will be Associate Administrator for Space Transportation System Acquisition. He will be responsible for the development and acquisition of the Space Transportation System, including the Space Shuttle and its upper stages, associated ground facilities and equipment, and system improvements.

In announcing this change, Frosch said, "This organizational move streamlines our Shuttle management system by freeing John Yardley to focus his attention on getting the Shuttle system built and flying, and by centralizing our Shuttle services in a new, user-oriented organization." (Spaceport News, Vol. 18, No. 23, John F. Kennedy Space Center, October 12, 1979, p.1)

- o Tests began recently on one proposed method of preventing the formation of possibly dangerous ice on the nose of the Space Shuttle's external tank. The method being tested is referred to as the "beanie cap" by personnel at the Launch Equipment Test Facility (LETF).

The necessity for the device became apparent when it was found that vapors from the liquid oxygen vent system at the top of the external tank may cause chunks of ice to form at the vent system's exit louvers. During liftoff, the ice chunks could dislodge and possibly damage the shuttle's critical protective tile system. To prevent any damage, several methods of preventing ice formation were devised.

The first such method to be tested at the LETF involves a cap which will be lowered over the top of the external tank and sealed by means of an inflatable collar. Then cold oxygen vapors are pumped from under the cap and vented some distance away.

The test equipment at the LETF enables technicians to verify not only the fit of the cap to the tank, but also such variables as tank and cap movement due to wind, orbiter ignition and the effects of solar heating and cryogenic shrinkage.

Should this method be adopted in actual use, the cap would be removed by a swing arm assembly and swung safely aside shortly before engine ignition. The "beanie cap" swing arm is not presently installed on the Launch Complex 39A Fixed Service Structure, and would have to be designed and fabricated and then tested.

Other possible systems of preventing ice buildup include, a hot air blower system, or a re-designed external tank vent system. Vapors from the hydrogen tank vent system do not pose an icing problem because they are removed by an existing swing arm vent system to a burn pond, a safe distance from the pad. (Ibid, p.1,2)

- o Each year the first full week of October, KSC observes National Employ the Handicapped Week, a nationwide program to acknowledge the accomplishments of disabled people and to inform all citizens of what they can do to eliminate the barriers still facing disabled people.

KSC has an active and ongoing program of selective placement for the handicapped person.

Through the KSC Handicapped Program Working Group, KSC has implemented an extensive program in recent years to provide non-discriminatory employment for handicapped people. Renovations have been made to most KSC buildings to ensure easy access by all employees. The Center also maintains contact with federal, state and local agencies that deal primarily with the handicapped, providing them with information concerning job vacancies. (Ibid, p.3)

- o The special staff of individual consultants that was asked last May to assess the adequacy of the NASA Space Shuttle management system has submitted its report to the NASA Deputy Administrator, Dr. Alan M. Lovelace.

The special staff consisted of: Richard C. McCurdy, former NASA Associate Administrator for Organization and Management; Willis H. Shapley, former NASA Associate Deputy Administrator; Maj. Gen. James Abrahamson, F-16 Program Director, United States Air Force; A. Thomas Young, Deputy Director, NASA Ames Research Center, Mountain View, Calif.; and John E. O'Brien, Assistant General Counsel for Procurement Matters, NASA Headquarters, Abraham Spinak, Associate Director, NASA Wallops Flight Center, Wallops Island, Va., was executive assistant.

Lovelace, in receiving the report and passing it on to Administrator Dr. Robert A. Frosch, said:

"This study was undertaken at my request in order to obtain an independent appraisal of the Shuttle management process which may have contributed to the sudden awareness of projected program cost increase which has been encountered during the past year. I want to commend the staff for their thoroughness and dedication during the four-month study. Their findings and conclusions constitute a very important input to our overall examination of Shuttle management."

The report contains eight major findings and conclusions excerpted as follows:

1. The original cost commitment for Shuttle development established an austere fiscal environment at the beginning of the program. This environment became more constraining under the annual budgets established in subsequent years.
2. The overall Shuttle management system has achieved a commendable level of accomplishment.
3. In the effort to live with funding limitations while still progressing acceptably toward completion, Shuttle management has generally set up work schedules that demanded more performance than could be delivered.
4. There has been a lack of adequate long-range planning and timely status reporting. Emphasis has been on the current fiscal year, with only secondary attention to succeeding years and estimates to completion.
5. The organization for the Shuttle Program appears to be functioning well from a technical standpoint, but is not functioning acceptably in the areas of schedule and budget. Strengthening of the organization at all levels is needed in these areas.
6. Fixed Shuttle delivery schedules and initial operations require a new management approach.

7. The operational phase of the Space Shuttle Program takes on added significance and importance as the design, development test and engineering phase comes to an end. Top NASA management should address the overall organization, external interfaces, institutional, and other management aspects of the operational phase. In particular, the NASA/Department of Defense interface needs immediate clarification to avoid misunderstandings which could have long-term consequences.
8. The near-term potential for unanticipated technical problems, schedule slippage, and cost growth is high and appropriate reserves should be included in all aspects of program planning.

(NASA Activities, Vol. 10, No. 11, November, 1979, pp.3-7)

- o Two experiments that will be part of the first payload to be carried into space by the Space Shuttle orbiter Columbia--the Shuttle Imaging Radar Antenna and the Ocean Color Experiment--have been delivered to Kennedy Space Center. The remaining five experiments are scheduled to arrive by the second week in October.

Columbia's first payload, called OSTA-1, is made up of seven experiments designed to carry out investigations for Earth resources applications. The payload, under the management of NASA's Office of Space and Terrestrial Applications will fly on the Space Shuttle's second orbital flight test scheduled for launch from KSC.

Designed and assembled by the British Aerospace Corporation for the European Space Agency as part of the joint ESA/NASA Spacelab program, the pallet is nearly identical to experiment pallets to be used in Spacelab missions. This is the first of two pallet systems, with the next scheduled to carry physics and astronomy experiments on the fourth Shuttle flight. (Ibid, pp.8,9)

- o A historic U.S.-Canadian project to advance communications via satellite ended in October when the world's most powerful communications satellite relayed video and voice signals for the last time.

The Communications Technology Satellite has demonstrated that such powerful satellite systems can bring low-cost television to remote areas anywhere on Earth.

More than 160 United States experiments were conducted with the satellite during more than three years, ranging from business teleconferences - designed to save time and travel expenses for businessmen - to emergency use during a disastrous 1977 flood.

The highly instrumented portable ground terminal was transported some 100,000 kilometers in support operations for the satellite, which is in synchronous orbit some 36,000 km in space.

The technology satellite has been a joint project of NASA and the Canadian Department of Communication. NASA's Lewis Research Center was manager of the U.S. experiments, which ceased in June of this year. Canada designed and built the satellite which, for the first time, operated in the 12 to 14 gigahertz frequency band. The Lewis center also furnished the solar-powered traveling-wave transmitter which has 10 to 20 times the broadcast power of current communications satellites. NASA did the pre-flight environmental testing on the spacecraft and launched it from the NASA Kennedy Space Center on Jan. 17, 1976. (Ibid, p.12)

- o An invention developed at KSC strikes a dramatic image on the cover of the current issue of NASA Tech Briefs. Illustrated amid zigzagging thunderbolts is a lightning detection and ranging system, used to monitor the atmosphere around Launch Complex 39.

The detector senses changes in the electric field during a lightning strike, and the presence or absence of very-high-frequency electromagnetic radiation. A strike from cloud-to-cloud produces two pulses, a pulse in the electric-field channel and one in the vhf channel; while a strike to the ground produces only an electric-field pulse. With a single pulse, the instrument indicates a "hit" within its sensing range. This ability makes it applicable for use as a shutter control for lightning photography, a ground-stroke counter, or a lightning warning, among other uses. It was developed by Carl L. Lennon (TI-INS-32).

Seven other inventions from KSC are included in Tech Briefs. KSC's Charles H. Bell (D1-NED-31) was responsible for the fiberoptic crossbar switch described in the issue. It automatically switches optical signals from input to output fibers without the problems associated with manual mechanical connectors and patch plugs. The old style devices do not lend themselves to automation, are susceptible to contamination and difficult to align, and have poor connector repeatability.

An inexpensive monitoring system developed by Robert L. Cason and John J. McStay (DD-FED-21) and Andrew P. Heymann, Sr. (PRC)) detects short circuits in underground or overhead power cables and displays the fault location at

a remote monitoring station. It operates through ground current sensors installed along a cable run.

Coleman J. Bryan and Clyde V. Moyers (TG-FLD-22) and Edward E. Wright, Jr. (VE-FSD-31) designed a method for continuously sterilizing plumbing systems such as those found in hospitals, clinics and biological testing laboratories. An Ethylene oxide/Freon 12 humidifier, originally planned for sterilizing potable water aboard the Space Shuttle orbiter, allows this on-line disinfection of plumbing.

KSC's Charles W. Bright (TG-FLD-22) and Lester J. Owens (DD-ESO) teamed with researchers from the Rancho Los Amigos Hospital in Downey, California, to improve artificial limbs. Tech Briefs describes a method of connecting a prothesis to the bone within an amputee's stump -- in a manner which promotes healing and lessens stress on the skin around the limb. A flexible shaft, with a socket at one end and a through-the-skin sleeve at the other, when surgically implanted at the bone allows the sleeve to move without breaking its seal with the skin. The new limb connector may be used for either an arm or leg prothesis.

A multiline telephone signaling system was the work of Pierce C. Toole (DL-NED-11), Jerry L. Belt, Reams Goodloe, and Donald B. Leiniger (PRC). This system permits spontaneous conferences, paging, and monitoring from key locations. Single telephones may be connected to a number of telephone lines, and users on from two to eight telephone lines in a network may be interconnected.

W. D. Sumrall (IBM Corp.) wrote a systematic approach for identifying computer test configurations for the Space Shuttle. His approach may be used to test other large complex systems, such as submarines, aircraft, and air traffic control networks. Using variables and constraints, he identified 55 allowable test configurations for the Shuttle.

Tile work on the Shuttle orbiter has resulted in the development of a method for repairing holes and cracks in very thin glass. The process, expected to correct x-ray tube windows, Dewar flasks, and other thin glass objects, was developed for the orbiter's reusable surface insulation. A slurry of glass frits is applied with a brush or spray gun and cured under a heat lamp. After repair, scanning by electron micrographs has proved that fill glass and base glass are homogeneous and the cracks completely sealed. Donald D. Helman, Jack W. Holt, and Laurence W. Smiser (all of Rockwell International Corp.) are credited with the process. (Spaceport News, Vol. 18, No. 24, John F. Kennedy Space Center, October 26, 1979, pp. 1,2)

- o The smoking lamp is out in the VAB, except in special approved areas, due to arrival last month of the Space Shuttle solid rocket booster propellant segments.

Several areas have been set aside and furnished with electric lighters for the use of smokers. These areas are: Tower A--Rooms 1A7 and 3A10; Tower B--Rooms 2B6, 6B10 and 10B6; Tower D--Room 6D23; Tower E--Rooms 1E6, 3E10B, 5E7 and 7E10; in the Low Bay, M&N--snackbar and crossover hallway on the first floor, and all areas on the second and third floors and the mezzanine; K mezzanine--all areas except the lab; K&L--second and third floors, except for MIX area on the second floor.

The smoking ban except in designated areas is in effect 24 hours a day, seven days a week. Immediately outside smoking rooms are large signs indicating that smoking is not allowed beyond that point. In order to assure compliance with the rule, fire inspectors hold daily walkdowns of the area. So far, no flagrant violations have been noted. No-smoking areas are being cleared of old cigarette butts and debris to assist in identifying any recent smoking activity.

Because of the nature of the SRB propellant and what could happen if it were accidentally ignited, no-smoking rules will be strictly enforced. A first offense will result in suspension for five days. The penalty for the second offense is dismissal. (Ibid, p.3)

- o During the fourth quarter of fiscal year 1979, fifty-six KSC employees received performance awards. Forty-three people were given certificates for superior performance in carrying out the functions and responsibilities of their respective positions. An additional thirteen employees received quality step increases. These employees and their organizations are listed below.

#### Performance Awards

Patsy R. Ashburn--SF  
James W. Austin--CP  
Lynn A. Barnett--VT  
Dorothy P. Bennett--DL  
William A. Berndt--CV  
Howard R. Breneman, Jr.--TI  
Kenneth W. Colley--VE  
Jessie M. Cook--SP  
Bobby R. DeLoach--TI  
Oscar M. Fell--VE  
William B. Glaser--VE  
Andrew J. Guillory--TO  
Janice L. Hawk--DE  
Billy L. Haynes--CS  
Dennis E. Heathcote--CP

Curt F. Martin--DD  
Barry S. Olton--CV  
Donald L. Orman--VE  
Stephen T. Pantano--VO  
Yvonne C. Parker--TI  
John B. Parks--DD  
John D. Phillips--CO  
James D. Polly--DF  
Norma Randall--CD  
Mary B. Remley--AP  
Lorenz G. Simpkins--TI  
Marion C. Spence--SF  
Angelo J. Taiani--TO  
William B. Trammell--VO  
George W. Warren--VT



Frank S. Howard--DD  
Suzanne F. Jamison--AP  
Samuel E. Kicklighter--TO  
Warren R. Kicklighter--TI  
Sallie L. Krell--DE  
William K. Lewis--VE  
William E. Lockwood--VT

Herbert D. Ward--CO  
Alfred D. Willis--TI  
Marvin I. Wright--DD  
Robert J. Yarbrough--CP  
Paul T. Yasaki--CV  
Harold Zweigbaum--TI

Quality Step Increase

James K. Amster--DL  
Edith H. Beard--PT  
Amador Capellin--DD  
J. I. Daniel--DO  
Donald F. Doerr--MD  
Daniel Evans--VE  
Allan R. Goldenberg--VE

Jimmie G. Hangartner--DF  
H. Dean Hunter--CO  
Beaufort Jones--AP  
Thomas G. Kreuzinger--DD  
Thomas M. Page--CO  
John Shramko--DE

(Ibid, p.3)

November 1979

- o Digging deeply and generously into inflation-strained pockets, KSC employees again topped their Combined Federal Campaign goal, collecting 111 percent of the \$106,000 goal.

Through November 6, a total of \$118,177 was pledged to the United Way of Brevard County, National Health Agencies and International Service Agencies, with 95 percent of KSC's federal workforce participating in the annual drive.

"It's been a most successful campaign," said KSC CFC Chairman Bill Holden, "thanks to all the hard work provided by our key solicitors and unit coordinators. It's also a tribute to our employees who, despite the economy, continue to give more every year."

Working with Holden on the KSC drive was Vice Chairman Terry Mitchell, and the Brevard County campaign was directed by Chairman Col. Jim Heinbaugh and Vice-Chairman Bill Huseonica, chief of KSC's Cargo Projects Control Office. Huseonica will move up to Brevard CFC Chairman next year. (Ibid, p.3)

- o Fernando Esparza, KSC's Hispanic Employment Program Manager and a supervisory mathematician in Information System's Computer Services Division, was recently elected Regional Director of the Atlanta Region of IMAGE, a national organization concerned with the public employment of Hispanic-Americans.

IMAGE represents Hispanics in the federal sector and their contractor, state and local workforces. With 105 chapters in 35 states, IMAGE's objectives are to implement equal opportunity and affirmative action plans in compliance with U.S. public laws.

In this position, Esparza will serve on IMAGE's national board of directors with its officers and nine other regional directors elected from throughout the country.

At KSC, Esparza coordinates the Hispanic Employment program, participating in the preparation of affirmative action plans relating to the Hispanic community. (Ibid, p.3)

**November 1-3.** The Space Shuttle Orbiter Columbia passed a major series of tests last week, taking it one step closer to first launch. The orbiter's three auxiliary power units (APUs) were tested for the first time in a series of "hot fire" runs designed to exercise most of the vehicle's major systems.

"The APU hot fire was an extremely hazardous orbiter test which involved many operational elements of the Center," said STS Processing Director Al O'Hara. "Even though we had several hardware, software and operational problems, the test was successful and demonstrated that our Shuttle test team is ready. We're looking forward to rollout of the orbiter from the Orbiter Processing Facility and a successful launch next year."

The APUs are hydrazine powered, and each powers one of three independent hydraulic pumps. The three hydraulic systems are used to gimbal the main engines, move the aerodynamic flight controls and perform other tasks during the launch and landing phases of flight.

The APU tests began Nov. 1 and continued until late evening, Nov. 3. The test series involved running each APU singly for a two minute checkout, then a 40-minute run of all three units during which a variety of systems checks were performed. Finally, two flight profile runs of approximately 15 minutes each simulated the launch and reentry phases of flight. There were several short delays in the series. One twelve hour delay was caused by a power failure in the Launch Complex 39 area during a storm.

The prime flight crew for Columbia's first mission, Commander John Young and Pilot Bob Crippen, as well as other astronauts, participated in the APU tests. All personnel were evacuated from the OPF during the tests, with the exception of two observers in the viewing room and astronauts monitoring the tests from within the orbiter's crew cabin.

Meanwhile, at the National Space Technology Laboratories in Mississippi, a scheduled 150-second static firing of the Space Shuttle main propulsion system was terminated after nine seconds of firing on Nov. 4. A sensor gave the automatic cutoff due to excessive pressure in the seal cavity of a high pressure oxidizer turbopump on engine No. 3.

During the cutoff sequence, engine No. 1 was damaged due to a hydrogen line rupture near the base of the engine nozzle, creating an imbalance of propellants in the combustion chamber. This caused a hotter-than-normal, "lox-rich" cutoff. The damaged engine was removed and shipped to the manufacturer's plant in California for thorough inspection and repair. It will be several days before a decision can be reached on the hardware to replace the engine for the next main propulsion system test. (Spaceport News, Vol. 18, No. 26, John F. Kennedy Space Center, November 23, 1979, p.3)

**November 2:** Center Director Dick Smith was in Washington Nov. 2 to face the bosses and stand on the carpet. But the bosses were smiling and the carpet they rolled out was red, for Smith was in town to receive the NASA Outstanding Leadership Medal at the 1979 NASA Headquarters Annual Honor Awards Ceremony.

In receiving the medal, Smith's past achievements as deputy director of the Marshall Space Flight Center, deputy associate administrator for Space Transportation Systems at NASA Headquarters and director of the Skylab Task Force also at Headquarters were cited.

While at Marshall, Smith served in positions of increasing responsibility before being appointed deputy manager of the Saturn program and later manager of that program. He then became director of science as such until he was named deputy director at Marshall.

For his contributions to the Apollo lunar landing and the Skylab programs, he previously received NASA's Exceptional Service and Distinguished Service Medals, respectively. He became director of KSC in September. (Spaceport News, Vol. 18, No. 26, John F. Kennedy Space Center, November 23, 1979, p.3)

- o NASA said Tuesday that it has firm payload commitments for the first 37 operational flights of the Space Shuttle, which are scheduled to begin in 1981, meaning that the Shuttle is "almost completely booked" through early 1984.

A total of 47 payloads are involved in the 37 flights. NASA indicated that 15 of those payloads will be for itself, 7 for the Defense Department, and 25 for other users.

In addition to these payloads, some 300 small self-contained payloads are scheduled to fly on the missions.

NASA reported in February that it had booked payloads for the first 28 Shuttle flights. At that time, it was planning six Orbital Test flights, with the maiden flight this month. The agency is now planning to conduct four test flights, with the first flight planned for April but not expected until July or August. (Defense/Space Business Daily, Vol. 107, No. 2, Friday, November 2, 1979, p.10)

- o NASA has awarded a contract to Western Union, from whom it is leasing its Tracking & Data Relay Satellite System (TDRSS), for a study to determine the feasibility of expanding the TDRSS. Two of the four TDRSS satellites to be orbited by WU will be dedicated to NASA use, and NASA is looking at the possibility of a third satellite because of a coverage gap for LandSat D data. (Ibid)

**November 3.** Dr. William H. Pickering, former Director of the Jet Propulsion Laboratory, was one of five aviation and space exploration leaders admitted to the International Aerospace Hall of Fame at a ceremony in San Diego October 20. The other men honored were Gen. Curtis E. LeMay, World War II bomber commander and later the leader of SAC; Lawrence B. Sperry, pioneering U.S. aviator and designer; Sir Thomas O. M. Sopwith, the famed British aircraft designer of both World Wars; and Prof. Willi Messerschmitt, foremost designer of German military aircraft.

Pickering had a key role in the development of U.S. space flight technology leading to the Apollo landings on the Moon. He also guided the nation's highly successful deep space probes to Mars, Venus and Jupiter. Since retirements from JPL, Dr. Pickering has remained active as an instructor at Caltech. (NASA Activities, Vol. 12, December, 1979, p.9)

- o Members of the Biomedical Office and Public Affairs Offices attended ceremonies Saturday, 3 November 1979, at the Shands Teaching Hospital, University of Florida, Gainesville, dedicating the new Hyperbaric Chamber Facility (HCF). The event coincided with a statewide divers' symposium on hyperbaric physiology and medicine. Dr. Jerry Modell, Chairman of the Department of Anaesthesiology and Director of the HCF, planned the ceremonies. Other speaking participants from the University Medical Center were included as well as Representative Bill Richardson who was instrumental in obtaining state funds for construction; Mr. Jerome Johns, a former patient in their small one-man chamber who endorsed the augmentation to the present capability for whom it is named; Dr. Will Deal, VP for Health Affairs; and Dr. Buchanan, who paid tribute to those at KSC who had worked to effect the long-term loan of the former KSC Hyperbaric Chamber, the core of the new facility. Following formal ceremonies, Mrs. Johns unveiled appropriate plaques, and attendees and guests enjoyed an inspection walk-through of the chamber and facility. (Notes [Buchanan to Center Director], 11/15/79)

**November 4.** The Auxiliary Power Units for the Space Shuttle Orbiter Columbia successfully passed a series of "hot fire" tests Nov. 1-3 at Kennedy Space Center. The three hydrazine-fueled units provide hydraulic power to steer the Orbiter's main engine nozzles during launch and to drive aerodynamic control surfaces during the Orbiter's flight through the atmosphere. The units were operated for up to 40 minutes in the tests which included simulations of the ascent and descent phases of a Shuttle mission.

Next major milestone for Columbia is an integrated test of all of its flight systems late this month. (Defense/Space Business Daily, Vol. 107, No. 8, Tuesday, November 13, 1979, p.57)

- o The failure of the Space Shuttle Main Engine cluster test on Nov. 4, with the subsequent damage to one of the three test engines, will result in another two to three month delay in the first launch of the Space Shuttle, NASA said last week. This would make June the earliest that the Shuttle could fly and a possible delay to the end of the year. The damaged engine has been shipped to Rockwell's Rocketdyne Division for inspection and repair. NASA is examining alternatives for replacing the damaged engine in the test stand at NSTL. (Ibid)

**November 5.** Guided bus tours of the John F. Kennedy Space Center for the month of October were up 2.3 percent over the same month in 1978, breaking a four consecutive month decline in tour patronage that began in June, when gas shortages cropped up around the country.

Guided bus tours of the nation's Spaceport and adjacent Cape Canaveral Air Force Station attracted 64,437 visitors during October, compared to 62,989 for the same month a year ago.

October tour patronage brought the cumulative total for the first 10 months of 1979 to 1,122,160, a drop of 1.2 percent below the 1,135,318 recorded over the same period of 1978.

Tour patronage through May of this year had been proceeding at a record pace as the Spaceport continued its buildup for the first manned orbital flight of the Space Shuttle.

But nationwide fuel shortages at the beginning of Florida's heavy summer tourist season caused attendance figures from June through September to drop. As fears of gas shortages around the state have eased, patronage has steadily increased.

In anticipation of increasing numbers of visitors to the Kennedy Space Center when the Space Shuttle begins operational and routine flights into space, TWA Services, KSC's concessionaire for the public tour and visitor program, recently announced it will invest up to \$8.5 million in construction of new visitor facilities. (NASA News Release No: KSC 188-79, November 5, 1979)

**November 6.** NASA Administrator Dr. Robert Frosch said last week that he would not be surprised, if, in addition to the European Ariane, there are other competitors to the Space Shuttle in the future. He said that one is possibly Japan. As for the Soviet Union, he said there is no indication that the Soviets will offer launch services to "undercut" Shuttle costs. Frosch said he had no recent knowledge about the reported development of a heavy lift launch vehicle in Africa [by a West German group]. As for Ariane, Frosch indicated he did not consider it as a major competitor to the Shuttle for a number of reasons: the fact that only four Ariane launches are planned a year; that the Shuttle can orbit most payloads at a much cheaper cost; and because of the flexibility and guaranteed launch ability of the Shuttle. (Defense/Space Business Daily, Vol. 107, No. 4, Tuesday, November 6, 1979, p.25)

**November 8.** NASA's John F. Kennedy Space Center has awarded a \$3,280,616 contract modification to Honeywell Information Systems, Inc., Federal Systems Operations, 7900 Westpark Ave., McLean, Virginia.

The contract extension is for continued maintenance and software support of the Space Shuttle Launch Processing System's Central Data Subsystem in KSC's Launch Control Center. For the first time under this contract, support will also be provided for the Honeywell 635 computer systems in KSC's Central Instrumentation Facility.

The new award covers the period from January 1, 1980 to September 30, 1980 as a firm requirement and includes annual options through the first quarter of Fiscal Year 1985.

The new award, coupled with \$33,317,578 in previous awards and the \$19,964,494 in options brings the aggregate value of the parent contract to \$56,562,688. (Spaceport News Release No. KSC-192-79, November 14, 1979. Also NASA Contract, NAS 10-8900, Modification No. 30)

- o The following is the Flight Assignment Manifest for the first 43 flights of the Space Shuttle.

Three Orbiters will be used for the flights -- 102, which will fly the first ten missions; 099, which will enter the program for flight 11; and 103, which will enter the program for flight 32. Forty-two flights, including the first 35, will be conducted from Kennedy Space Center. The first flight is now officially scheduled for April, but not expected before July-August. (Sic) 1980)

Flight	Date	Flight Assignment Manifest Payload
1 (102)	4/80	Development Flight Instrumentation (DFI), Induced Environment Contamination Monitor (IECM), Aerodynamic Coefficient Instrument Package (ACIP). Number of crewmen/days in orbit: 2/3.
2 (102)	11/80	DFI, IECM, ACIP, OSTA-1 Pallet. 2/5.
3 (102)	2/81	DFI, IECM, ACIP, PDRS Test Article. 2/7.
4 (102)	5/81	DFI, IECM, ACIP, OSS (physics & astronomy) Pallet. 2/7.
5 (102)	9/81	TDRS-A, ACIP. Will use 2-stage IUS, with SSME rated at 100/109%. 2/2.
6 (102)	10/81	SBS-A, Intelsat F-5, ANIK-C/1, ACIP. To employ two SSUS-D's, one SSUS-A. 3/3.
7 (102)	1/82	Galileo, ACIP. Will employ 3-stage IUS. 2/1.
8 (102)	2/82	TDRS-B, ACIP. Will employ 2-stage IUS. 2/1.
9 (102)	3/82	Defense Department Mission 82-0, ACIP.
10 (102)	4/82	Spacelab 1. 6/7.
11 (099)	6/82	TDRS-C, Shuttle Pallet Satellite-01 (SPAS). 2/3.
12 (102)	6/82	SBS-B, ANIK-C/2, Intelsat F-6, SILTS (Shuttle Infrared Leeside Temperature Sensor), SEADS, SUMS. To employ two SSUD's and one SSUS-A. 3/3.
13 (102)	7/82	DOD 82-1, SILTS, SEADS, SUMS. 2/1.
14 (099)	8/82	Spacelab 2. 6/9.
15 (102)	9/82	TDRS-D, Insat-1A, SILTS, SEADS, SUMS. To employ 2-stage IUS and a SSUS-D. 3/2.
16 (102)	10/82	LDEF deployment, SMM retrieval, OMS Kit, SILTS, SEADS, SUMS. 3/3.
17 (099)	11/82	Insat-1B, Material Science Pallet, RCA-D, ANIK-D/1. To employ three SSUS-D's. 3/9.
18 (102)	11/82	Spacelab-3, SILTS, SEADS, SUMS. 5/7.
19 (099)	12/82	DOD 83-1.
20 (102)	1/83	Palapa-B-1, Syncom IV-1, RCA-E, OSTA-2, SILTS, SEADS, SUMS. To employ two SSUS-D's. 3/5.
21 (099)	2/83	Solar Polar Mission. To use 3-stage IUS. 2/1.
22 (102)	2/83	A reflight opportunity, SILTS, SEADS, SUMS. SEADS, SUMS. To employ two SSUS-D's. 3/5.
23 (099)	3/83	Life Science-1, Earth Radiation Budget Experiment (ERBE). 6/10.
24 (102)	4/83	Syncom IV-2, AMPTE, Palapa-B/2, RCA-F. To use three SSUS-D's. 3/4.
25 (099)	4/83	DOD 83-2.



26 (099)	5/83	DOD 83-3.
27 (099)	6/83	Spacelab (physics & astronomy). 6/9.
28 (099)	8/83	DOD 83-4.
29 (099)	9/83	DOD-83-5.
30 (099)	10/83	LDEF retrieval, GOES-F. To use a SSUS-D. 3/3.
31 (099)	11/83	Spacelab-BMFT-D1. 6/10.
32 (103)	12/83	Space Telescope, OMS Kit. 3/2.
33 (099)	1/84	Syncom IV-3, Arabsat-A, PRC-1, AT&T-1. Will use two SSUS-D's and one SSUS-A. 3/4.
34 (103)	1/84	A reflight opportunity.
35 (099)	2/84	DOD 84-1.
1W (102)	2/84	Tiros-N. 3/3. This is the first launch from the Western Test Range.
36 (103)	2/84	Syncom IV-4, Arabsat-B, PRC-2, AT&T-2. Two use two SSUS-D's and a SSUS-A. 3/4.
37 (099)	3/84	Reserved for a planetary mission. 2/1.
38 (103)	3/84	A reflight opportunity.
39 (099)	4/84	Spacelab-2 (physics & astronomy). 6/7.
40 (103)	5/84	DOD 84-2.
41 (099)	5/84	Spacelab (applications). 5/7.
42 (103)	6/84	ANIK-C/3, Materials Science-2 Pallet, SSUS-D payload opportunity. 4/7.

(Defense/Space Business Daily, Vol. 107, No. 6, Thursday, November 8, 1979, p.38)

**November 9.** President Carter has signed the \$72 billion FY '80 HUD-IA appropriations bill which includes \$4.924 billion for NASA. (Defense/Space Business Daily, Vol. 107, No. 7, Friday, November 9, 1979, p.47)

**November 14.** As a result of the recent test failure of the Space Shuttle Main Engine, NASA is removing the three main engines from the Shuttle Orbiter Columbia at Kennedy Space Center in order to strengthen a hydrogen pipe ("steerhorn") which failed during the test.

NASA has already strengthened the pipe because of an earlier test failure but is planning additional strengthening methods to be on the safe side, according to Shuttle program director Mike Malkin. He noted that the pipe had not been strengthened in the recent test. The break occurred at a welded joint.

Malkin attributed the failure to a peculiar oscillation effect which occurs when the engine is started and when it stops. However, if the problem occurred during ignition of the engine on the launch pad, the engines would

be stopped immediately without harm, he said. The problem would not occur when the engine stops as planned in space because the pressure would be less.

Malkin said that he hopes that the SSME test program at Bay St. Louis, Miss., can resume before the end of the year and be completed by next May.

As a result of the setback, he said that the earliest the Shuttle could make its maiden flight is June 1980, with a 50/50 chance that it will occur by the August-September period. The prior earliest date for launch was April, with a 50 percent probability of launch by July.

Moreover, Malkin said that the first operational flight of the Shuttle will probably be set back from September 1, 1981, to November 1981. (Defense/Space Business Daily, Vol. 107, No. 7, Wednesday, November 14, 1979, p.64)

- o President Carter expressed his full support for the Space Shuttle development and production program to NASA Administrator Frosch in a 15-minute private meeting at the White House and indicated that he would provide all the necessary funds to complete the program on the currently planned schedule.

The NASA administrator said that the President is fully backing the program because of its importance to science, national defense, U.S. commercial needs and as a contribution to and symbol of U.S. technological progress.

The military need for the reusable, flexible launch system, including SALT monitoring surveillance satellites, is considered the primary reason for the Administration's as well as the expected congressional support.

The Carter Administration has already provided an additional \$220 million for the Shuttle in FY '80 and will seek an additional supplemental of several hundred million dollars [expected to be about \$300 million]. FY '81 funding for the Shuttle will also be increased over the approximately \$1.1 billion planned at the beginning of this year.

Frosch said he told the President that the difficulties NASA is experiencing in developing the Shuttle are not "major central technical problems" but are "technical odds and ends. . . small problems which must be fixed" and which cause delays in the program and concomitant cost problems.

He indicated that the Space Shuttle Main Engine will be the pacing item in the program, but he said there are no "major or intrinsic flaws" with the engine, only normal problems expected in this type of program.

Frosch said that the Shuttle's reusable surface insulation tiles, which have encountered a strength problem, necessitating a partial replacement, is "not likely to be the pacing item" in the Shuttle schedule. Only about 11-12 percent of the tiles are having to be replaced. [The replacement tiles, which are installed the same way as the original tiles, are failing at about the same rate.]

As a result of the recent SSME test failure, Frosch said that the earliest that the Space Shuttle could make its first flight is June 1980, adding that it is most likely that the flight will be made in the August-September period. According to the director, a maximum schedule would include resumption of SSME testing in December; mating of the Shuttle components in March and then moving the mated Shuttle to the pad for launch preparations; test firing the SSME system on the launch pad in May; and launching the Shuttle as early as the end of June.

Frosch said the President asked to be kept informed of any changes in the status and schedule of the Shuttle as the first flight nears. (Defense/Space Business Daily, Vol. 107, No. 11, Friday, November 16, 1979, pp.72,73)

- o NASA is now estimating the Shuttle production program cost in FY '80 dollars to be \$4 billion, compared to a \$3.1 billion estimate at the beginning of the year. Estimates are rising as additional problems occur in Shuttle Development. NASA recently testified that the production cost estimates have risen 20 percent since the beginning of the year. The cost estimate increase since the beginning of the program is put at 30-35 percent. The

production program includes the manufacture of the second, third and fourth Space Shuttle Orbiters; refurbishment of the first Orbiter; manufacture of the production External Tanks and Solid Rocket boosters; provision of additional main engines and certain flight support. Contracts with Rockwell International, prime contractor for the Orbiter, have not yet been signed. (Ibid, pp.73-74)

**November 15.** NASA Headquarters issued a statement that "NASA has no plans, in the foreseeable future, for a return voyage to the Moon either manned or unmanned, nor to establish a space station or settlement on the lunar surface, nor to send a manned mission to Mars." (Defense/Space Business Daily, Vol. 107, No. 14, Wednesday, November 21, 1979, p.96)

**November 16.** More than 500 civil service and contractor employees were honored at the Annual KSC Awards Ceremony last Friday. The awards included both NASA-wide and Center honors.

Presiding at his first awards ceremony as Center Director, Richard G. Smith expressed his pleasure with being here and his confidence in the Center employees and contractors. Smith said, "I am very proud to be part of a team that is so well known for their successes."

NASA-wide awards included seven Exceptional Service Medals given for "significant achievement or service characterized by unusual initiative or creative ability," and the NASA Equal Opportunity Medal.

In presenting the seven NASA Group Achievement Awards and Public Service Group Achievement Awards, Smith said, "In many ways this is the ultimate award you can receive. . . because the great accomplishments of the space program have been brought about through a team effort which I think is the greatest mankind has ever seen."

Topping the Center awards were the presentations of the Director's Award to Raymond L. Clark, director of Design Engineering, the KSC Woman of the Year Award to Jean String, Physical Security Specialist, and 30 Certificates of Commendation.

Three letters from President Jimmy Carter were presented for first year cost savings to the government totaling more than \$50,000.

Fifty two people received their 30, 35 or 40 year service plaques. In presenting the plaques, Deputy Director Gerald D. Griffin reminded the audience, "It is the experience which people like you have that makes it possible to do the impossible."

#### Director's Award

Raymond L. Clark

#### Woman of the Year

Jean S. String

#### Equal Opportunity Award and Medal

Hugh W. Harris

Presidential Letters of Commendation

H. Jack Grames  
Norman K. Perry  
John P. Wise

40-Year Service Awards

Robert H. Clark  
James C. Fulton

35-Year Service Awards

J. Armstrong  
A. Carroll  
G. Haile  
H. Heidler  
W. Kavanaugh  
R. Kernan  
A. Kuchta  
C. Magee

M. Markum  
G. Morford  
W. Nichols  
M. Shelton  
H. Shockey  
S. Tatham  
W. Taylor

Exceptional Service Medals

John Conway  
P. A. "Frenchy" Fagnant  
John Lyon  
Gilbert Mayer

Alfred O'Hara  
James Phillips  
Creighton Terhune

30-Year Service Awards

G. Anderson  
C. Arnau  
D. Bennett  
C. Brown  
E. Clegg  
C. Coates  
R. Crowell  
J. Finn  
R. Funkhouser  
D. Gerber  
J. Hammond  
B. Huddleston

J. Kaufman  
L. Keene  
B. Kenerly  
R. Kinch  
M. Konjevich  
R. Lealman  
R. Loennig  
G. Madery  
R. Nagle  
L. Nonamaker  
C. Perry  
A. Pickett

R. Rabren  
J. Richardson  
A. Risley  
R. Ruby  
D. Sheppard  
O. Sparkman  
E. Spivey  
W. Stelges  
C. Wade  
A. Watson

## Certificates of Commendation

J. Barfus	H. Ford	T. Levann	W. Stampley
R. Buckley	C. Green	R. Luken	J. Summa
H. Clark	R. Hahn	R. MacCurry	T. Tieche
C. Clary	J. Jamison	V. Mandese	B. Tolson
G. Crawford	M. Kinnan	J. Meyer	J. Towles
R. Enlow	E. Lamar	W. Moore	M. Truitt
D. Flowers	F. Law	H. Springer	M. Williams

(Spaceport News, Vol. 18, No. 26, John F. Kennedy Space Center, November 23, 1979, pp.4,5)

**November 19.** Through FY '79, Kennedy Space Center awarded 36 contracts valued at \$160.5 million for Space Shuttle-related construction, of which \$26 million went to small businesses. Of the \$111 million in subcontracts awarded for the work, \$64.7 million went to small firms. Small minority firms received \$26.3 million, or 24 percent, of the subcontract awards, "Largely as the result of the 20 percent minority subcontracting goal which was set for the Shuttle construction effort," NASA said. (Defense/Space Business Daily, Vol. 107, No. 12, Monday, November 19, 1979)

**November 21.** NASA has concluded that the use of defective welding wire sharply weakened the weld in the segment of the hydrogen line which failed in a test Nov. 4. An examination of two lots of the welding wire has revealed that about 20 percent of the wire is defective. The leak in the hydrogen line occurred after a premature shutdown caused by excessive pressure in an oxygen turbopump in another engine. The cause of that problem has not been diagnosed. (Defense/Space Business Daily, Vol. 107, No. 14, Wednesday, November 21, 1979, p.96)

- o The Orbital Maneuvering System (OMS) engine for the Space Shuttle Orbiter, built by Aerojet Liquid Rocket Co., has successfully completed its qualification testing at White Sands and is ready for orbital flight. During qualification tests at White Sands, the OMS engine conducted 98 firings and accumulated 6076 seconds of firing time, covering "all conditions expected in actual flight," Aerojet said. It added that the engine meets the original NASA goal of reusability for 100 missions. Two OMS engines are currently being installed at KSC on the Space Shuttle Columbia, which is scheduled to make the first Orbital Test Flight in late June. (Ibid)

**November 26.** Precision Fabricating & Cleaning, Inc. of Sharpes, Florida has won a \$1,228,615 contract with NASA's John F. Kennedy Space Center.

The fixed price contract extends through December 31, 1980. During this period, the firm will fabricate 16 different pneumatic control panels to be installed in the Space Shuttle Mobile Launch Platform No. 2.

The panels, which range in size from 3 to 12 feet in length and 5 feet in height, are for the primary distribution and control of high pressure nitrogen and helium gas. The gases are used to purge and pressurize the Space Shuttle vehicle and other systems on the Mobile Launcher Platform, before propellant loading operations and launch.

The action initiates a new contract with the small business firm, which holds several other NASA contracts. An earlier contract for identical panels within Mobile Launcher Platform No. 1 was won by another firm. (Spaceport News, Release No: KSC 238-79, November 27, 1979. Also NASA Contract, NAS10-9717)

**November 27.** New World Construction Inc., Titusville, Florida, has been awarded a contract for \$161,213 to modify the 247-foot-high Fixed Service Structure on the Space Shuttle's Launch Pad A.

The work is part of a project designed to prevent ice damage to the Space Shuttle Orbiter's thermal protection system during liftoff.

The Titusville Firm will strengthen the frame steel framework of the Service Structure, install a hinge column, various piping lines and electrical work to prepare it for the addition of another swing arm. Swing arms got their name because they ordinarily extend out from the service structure to carry electrical connectors, propellant lines or gases needed on board the rocket, and then swing back out of the way just before liftoff.

The new Shuttle swing arm, to be installed by KSC personnel, will be located between the Fixed Service Structure's 207 and 227 foot levels. It will support a device known unofficially as the "beanie cap" which will be lowered over the top of the Space Shuttle's external tank which contains supercold liquid oxygen and liquid hydrogen propellants, and is sealed by means of an inflatable collar.

The need for the new system became apparent when it was found that vapors from the liquid oxygen vent system at the top of the external tank could cause chunks of ice to form at the vent system's exit louvers. During

liftoff, the ice chunks could dislodge and possibly damage the orbiter's protective tile system.

Heated nitrogen gas at a temperature of about 200 degrees F. will be introduced into the "beanie cap" through flexible ducting. The hot nitrogen will mix with the cold liquid oxygen vapors being vented at a temperature of about 297 degrees below zero F.

A return duct will carry the gas mixture back across the swing arm to the Fixed Service Structure where it will be vented into the air away from the external tank. The swing arm will be retracted to the parked position, approximately two minutes prior to liftoff.

The work being performed by New World Construction is under a contract set aside for small business firms. (NASA. News Release No. KSC 244-79, December 6, 1979)

**November 28.** Chairman Edward P. Boland (D-Mass.) of the House HUD-IA Appropriations Subcommittee has "directed" NASA to develop a modified Centaur upper stage for the Space Shuttle if it intends to proceed with its plans to conduct the Galileo Jupiter Orbiter/Probe mission in 1984.

The use of the Centaur would allow the Galileo to be launched as a single spacecraft, rather than as a split mission requiring two Space Shuttles and two yet-to-be developed Inertial Upper Stages (IUS's), Boland said.

This would save the cost of developing improvements needed for the IUS and of making further weight reductions in the Space Shuttle with their attendant risk. More importantly, this plan would provide the nation with a greatly improved space transportation capability which would benefit the entire space program, according to Boland.

The Boland directive, contained in a letter to NASA Administrator Frosch on Nov. 28, is a continuation of a two-and-a-half-year dispute on the Galileo program between the congressman's committee and the three other congressional committees with jurisdiction over the NASA budget. The dispute peaked this fall when the HUD-IA appropriations bill was stalled over the question of whether Boland's committee could by itself prevent NASA from proceeding with the restructured 1984 Galileo mission. The opposition was led by Sen. Charles McC. Mathias (R-Md.), ranking minority member of the Senate HUD-IA Appropriations Subcommittee, who won that battle.

Therefore, Boland does not have the authority to direct NASA to develop the Centaur, which is built by General Dynamics, but as chairman of one of the



two NASA appropriations subcommittees, he has a major say in what funds NASA gets in the future. (Defense/Business Daily, Vol. 107, No. 20, Monday, December 3, 1979, p.138)

- o Before the project's biggest critic, the House HUD-IA Appropriations Subcommittee, NASA Administrator Frosch defended the agency's plans for a dual Galileo Jupiter Orbiter/probe mission in 1984, calling the revised plan the least expensive way to carry out the mission, which he said is NASA's highest priority planetary mission.

NASA had intended to launch the JOP as a single spacecraft in January 1982 with a Space Shuttle/Inertial Upper Stage (IUS); but concluded that the combination would not have the required thrust to carry out the mission.

According to Frosch, after studying various alternatives, NASA concluded that "the most economical and efficient alternative" is to utilize separate Space Shuttle/IUS launchers for the Galileo Orbiter and Probe, and to shift the launches to the next launch window which occurs in February-March 1984.

Frosch said the revision in program plans would boost the Galileo mission cost by \$153 million to \$603 million, with all of the increase resulting from the two-year delay in development, plus the cost of developing a carrier spacecraft for the probe. The Galileo development estimate is now \$449 million, of which \$112 million has been obligated to date, with another \$154 million planned for mission operations data analysis. In addition to the \$153 million project cost increase, an additional \$72 million would have to be spent for additional launch costs, for a total increase of \$225 million.

Subcommittee chairman Edward Boland (D-Mass.) and other members made it clear that they are not happy with the increase costs of the program, which they did not support in the first place, but were unable to get NASA to admit there is a better alternative.

Frosch said the primary alternatives to the dual 1984 Shuttle/IUS launch of Galileo were:

- 1) Launching the Galileo on a single Titan-Centaur in 1982. NASA concluded, however, that "It is not possible to procure a Titan-Centaur in time for the 1982 launch opportunity."
- 2) Development of a Centaur upper stage for the Shuttle to replace the IUS. While the Centaur "appears to be a more capable upper stage" for deep space missions than the IUS, it would cost at least \$100 million more to develop than the IUS for the 1984 mission. (Defense/Space Business Daily, Vol. 107, No. 18, Thursday, November 29, 1979, pp.123, 124)

**November 29.** The NASA Administrator told Congress that NASA would prefer development of the trouble-plagued Inertial Upper Stage (IUS) to be continued by the Air Force, rather than having to go to another stage for the Space Shuttle such as Centaur. However, NASA has "not tried to interfere or be involved" in the Air Force decision.

Frosch told the Senate HUD-IA Appropriations Subcommittee that the principal development problems have been solved and the vehicle can be successfully developed, albeit over original cost estimates. Frosch said he did not know what the overrun was on the IUS development by Boeing.

Asked if he felt there was a danger of the IUS being cancelled by the Air Force, Frosch replied: "I don't know. It is one of a set of options" that the Air Force is considering. (Defense/Space Business Daily, Vol. 107, No. 19, Friday, November 30, 1979, p.129)

- o NASA Administrator Frosch met at the White House in what he called the "final" meeting on the agency's FY '81 budget request. Frosch is seeking a reclamation of key items excised by the Office of Management & Budget. Reportedly at the top of the list of projects NASA would like restored is the Solar Electric Propulsion Stage (SEPS). Go-ahead for the National Oceanic Satellite System (NOSS), which was also cut from the agency's FY '80 budget request to OMB, is also sought. OMB is said to have okayed the agency's top priority new start, the Gamma Ray Observatory. (Ibid, p.130)
- o During November: KSC's Saturn 1B rocket returned home after spending 18 months in Japan on loan to the Space Science Exposition in Tokyo as part of the largest foreign display of United States space hardware ever held.

The rocket, identical to the launch vehicles which carried Skylab and Apollo Soyuz Test Project astronauts into space, will now undergo a six to eight month fix-up period, and then be horizontally displayed at the Visitors Center. All display costs will be picked up by the Exposition's sponsoring organization, the Association for Space Science Exposition.

More than 11 million people attended the Exposition which featured hundreds of exhibits and space artifacts on loan from NASA centers, the Smithsonian's Air and Space Museum and other American space-related organizations, as well as from several Japanese space groups. Originally scheduled to run from Sept. 16, 1978, to January 15, 1979, the Exposition was extended an additional six months to accommodate the overwhelming public response. The one-day record for visitors at the Exposition was well over a quarter of a million people. (Spaceport News, Vol. 18, No. 25, John F. Kennedy Space Center, November 9, 1979, p.1)

December 1979

- o A key experiment for the first Space Shuttle flight mission was installed in the vehicle's cargo bay here on November 28.

The experiment called the Induced Environmental Contamination Monitor is a 376 kilogram (830-pound), trunk-sized package containing 10 detectors to check for contaminants in and around the cargo bay. Such contaminants might damage other equipment, satellites, or experiments also present in the cargo bay during a mission.

Substances to be monitored by the detectors could be produced by outgassing from materials within the orbiter, as well as products from reaction control jets or propulsion units.

Installed with the detector package was a mounting and release mechanism which connects the package (or other experiments) to a pallet in the cargo bay. The release mechanism is a latching device which will hold an experiment, release it during a flight and re-attach it when required.

In the case of the environmental monitor, the first two Shuttle flights call for the package to remain mounted throughout the flight. On the third mission, the monitor package will be released and moved about within the cargo bay and outside the orbiter body by means of the remote manipulator arm, and then re-secured.

On Spacelab flights, the monitor will be part of the palletized experiment package.

The environmental monitor was developed under contract with the Marshall Space Flight Center. Several companies and one university took part in the design and construction of the various detection instruments. The release mechanism was designed, built and tested at Marshall. (Ibid, pp.1,2)

- o Thomas Utsman has been appointed deputy director of KSC's Technical Support Directorate. The appointment became effective December 2.

As deputy director, Utsman will be assisting in the general management of any technical support required to conduct KSC launches and tests. Technical Support is responsible for maintenance and operation of test and launch complex facilities and related ground support equipment. The Emergency Preparedness Program at KSC also falls under the TS Directorate.

Prior to his new appointment, Utsman served as director of Operations Management for TS. Previously, he had been associate director, Design Engineering.

Utsman joined KSC in 1963. Since that time, he has served as deputy director, Project Management; technical assistant to the associate director for Facilities and Systems Management; and chief, Shuttle Project Engineering Office. (Ibid p.3)

- o Center Director Richard G. Smith recently presented the first KSC Contractors' Aerospace Awareness Panel Team Awards to groups from Planning Research Corporation, Wackenhut, and Unified Services, Incorporated.

The award, to be presented once or twice a year, was established by the Awareness Panel to recognize two or more persons assigned to work together to accomplish a specific goal in support of the KSC effort.

A team award was presented to PRC's Multi-use Mission Support Equipment Team, responsible for the design, development and systems integration of equipment essential to the processing of Shuttle payloads at various KSC facilities.

USI's VAB custodial crew was presented an award for providing support during water deluge tests in High Bay 3, readying platforms in the High Bay 2 checkout cell to support the arrival of the first flight external tank, and services performed on the mobile launcher platform during checkout operations at Pad A.

Wackenhut's award was presented to their Protective Services Engineering Team for providing recommendations for appropriate fire suppression and detection systems, and monitoring the design, installation and maintenance of fire protection and life safety systems in Shuttle support facilities. (Ibid, p.4)

**December 5.** NASA has reported to Congress that it is projecting a "steady state" cost of about \$900 million to \$1 billion annually (FY '80 dollars) for operation of the Space Transportation System. It noted that the STS operation budget level is "somewhat dependent on flight rate and reimbursement levels."

Since this steady state funding estimate is about a billion dollars less than NASA is spending in FY '80 for Space Shuttle DDT&E and production and Space Flight Operations, if NASA gets budgets at the \$4 billion level (adjusted for inflation) or higher, "then there could be increased funding for the non-STS program elements of the NASA budget" in the future, the agency said. (Defense/Space Business Daily Vol. 107, No. 22, Wednesday, December 5, 1979, p.152)

- o NASA earlier this year estimated the cost of Space Telescope development at between \$485 and \$530 million, with another \$525-\$620 million needed to operate the telescope over its 15-year lifetime beginning in FY '84, for a total of \$1.010-\$1.130 billion in FY '80 dollars. Assuming a 5 percent annual inflation, this estimate rises to \$1,425-\$1,600 billion; with a 7 percent annual inflation, the total becomes \$1.670-\$1.885 billion. [These estimates do not include civil service personnel costs or general T&DA support, since these costs are relatively fixed. NASA expects to use 200 civil service personnel during the six year ST development phase, at an annual cost of \$3.75 million; 65-75 during the operations phase, costing \$2 million per year.] (Ibid, p.156)

**December 6.** The RCA Communications Satellite, RCA Satcom-C was launched aboard a Delta rocket, 150. Liftoff from Pad 17A, Cape Canaveral Air Force Station occurred at 2035 EST.

RCA Satcom-C, the third spacecraft in a USA domestic communications satellite system was injected into an elliptical transfer orbit, with an apogee of 22,252 statute miles (35,811 kilometers), a perigee of 104 statute miles (167 kilometers), and at an angle of 23.8° when crossing the equator.

Approximately 25 minutes after launch a subsidiary of RCA, RCA American Communications, Inc. (RCA Americom), will assume control of the spacecraft after separation from the launch vehicle. Operating through two Telemetry, Tracking, and Command (TT&C) ground stations located at Vernon Valley, New Jersey on the east coast and at Moorpark, California on the west coast, the RCA controllers, at a selected apogee, will fire a solid propellant motor on board the spacecraft to inject the satellite into a drift orbit just below synchronous altitude. When RCA Satcom-C has reached the designated location over the equator at approximately 132° west longitude, the

reaction control system will be activated to raise it to a fully synchronous orbit at an altitude of 22,300 miles. From this location over the Pacific Ocean it can provide reliable, continuously available telecommunications coverage for all the 50 states.

The RCA Satcom system will consist of three satellites in orbit, the two TT&C stations, a satellite control center at each station, and a series of communications stations located near major USA population centers. The system will be greatly expanded by adding new communications stations when all satellites are operational.

The RCA Satcom system is a commercial business venture, a continuation of the trend to utilize space technology as the best and most economical means of meeting expanding electronic communications needs. RCA provides its own spacecraft, and reimburses NASA for the cost of the Delta launch vehicle and launch support services. The new system will provide telecommunications services which includes private-line analog and digital data for business, voice and TV services to subscribers, and message and toll telephone service for Alaska.

The RCA satellites are built for RCA Americom by another company division, RCA Astro-Electronics. The spacecraft design is different from previous USA communications satellites in that it is three-axis stabilized by means of flywheels and control jets. In the RCA design the bifold solar arrays are in two wings each 61 inches by 89 inches overall and are constantly exposed to sunlight to always produce power. The solar cells are expected to produce up to 740 watts of power for 8 years. A backup system of nickel cadmium batteries supplies power when the satellite is in Earth's shadow.

The spacecraft has 24 active transponders, or channels, each capable of relaying one color TV program or more than 1200 one-way telephone calls. In actual operation the message traffic will be divided between digital data, teleprinter, telephone, television, data fax, or other broad-band electronic transmissions, as the needs of the customers dictate. The RCA-C spacecraft is augmented over RCA-A and B by having four spare transponders which can be switched into service in case of failures.

The RCA-C Satcom spacecraft weighs about 1974 pounds (895 kilograms) at launch, more than other synchronous orbit communications satellites previously launched on the Delta. The design lifetime is 8 years. (Launch Mission Summary and Sequence of Events, RCA-C, Delta 150, John F. Kennedy Space Center, NASA, November 28, 1979, pp.4,5)

- o If the Space Shuttle is to make its maiden flight June 30 as scheduled for NASA, which says there is only a 10 percent chance of the launch being made by that time, the following events will have to occur at Kennedy Space Center: Rollout of the Orbiter Columbia from the Orbiter Processing Facility to the Vertical Assembly Building in late March; rollout of the complete Shuttle system from the VAB to Launch Pad 39A in mid-April; flight readiness firing (a 20-second firing of the Shuttle main engines of the launch pad) in mid-May. NASA also has to achieve Space Shuttle Main Engine Certification prior to launch. (Defense/Space Business Daily, Vol. 107, No. 23, Thursday, December 6, 1979, p.163)

**December 7.** The pull-testing, removal and installation of reusable surface insulation tiles on the Space Shuttle Orbiter Columbia at Kennedy Space Center is proceeding at a pace that will see completion within the schedule set for rollout of the Columbia from the Orbiter Processing Facility (late March).

Through Nov. 29, the most recent count available, there were 28,100 tiles installed on the Columbia, leaving 3090 cavities. However, Associate Administrator John Yardley says that as many as 10,000 tiles which have been installed on the Orbiter may prove to be under-strength and have to be removed and rebonded. As many as possible of the approximate 6800 white tiles on the Orbiter are being pull-tested along with some 18,000 of the 24,110 black tiles. Certain of the tiles, i.e., under an inch thick, are not going to be pull-tested; some others, which because of their curvature cannot be pull-tested, will be removed and rebonded without testing.

To date, NASA has pull-tested 7400 tiles, of which 6023 have completed two pull-tests and have been certified as acceptable and 985 found unacceptable and removed. The remainder face a second pull-test.

The current pace of rebonding is up to between 100 and 200 tiles per day. (Defense/Space Business Daily, Vol. 107, No. 24, Friday, December 7, 1979, p.170)

**December 9.** A \$50 million RCA communications satellite was lost in space by company officials.

Contact with the Satcom III spacecraft was lost shortly after 1:57 p.m. when ground controllers at RCA's Vernon Valley, N. J. tracking station fired a spacecraft motor to put the satellite into its permanent orbit over the Pacific Ocean.

A formal statement issued by RCA American Communications Inc.--a subsidiary that manages the Satcom operations -- offered no explanation of what might have gone wrong.

RCA has asked the North American Air Defense Command in Colorado Springs, Colo., and the National Aeronautics and Space Administration to help find the spacecraft. (Jim Ball, "Orlando Sentinel Star," Orlando, Florida, Tuesday, December 11, 1979.)

**December 10.** The Senate Commerce Committee, responsible for the NASA authorization in the Senate, informed NASA late last week that it concurs in the agency's decision to split the Galileo Jupiter Orbiter/Probe mission into two missions and to conduct them in 1984 using the Space Shuttle/IUS.

The House HUD-IA Appropriations Subcommittee, a long-time critic of Galileo, told NASA late last month that it would have to substitute a modified Centaur for the still-to-be developed IUS if it wants to conduct the mission.

The position of the Commerce Committee and its chairman, Sen. Howard Cannon (D-Nev.) is that the NASA administrator is the man responsible for determining how best to conduct the NASA mission, which involves complex problems, and that there is no indication that he has not fully studied the matter before coming to a decision on the best and most effective course of action. The committee does not like the idea of having two "program managers" for NASA -- the administrator and Congress. If Congress is not happy with the course being followed by the administrator, then it should get a new administrator, the committee believes. However, as it stated last week, it believes that NASA Administrator Frosch is proceeding properly on Galileo.

Still to be heard from are the Senate HUD-IA Appropriations Subcommittee and the House Science & Technology Committee, both of whom have supported Galileo in the past, despite opposition by the House HUD-IA Appropriations Subcommittee. Sen. Charles McC. Mathias (R-Md.), ranking minority member of the Senate subcommittee and an influential voice on the subcommittee, has endorsed the revised Galileo plans. (Defense/Space Business Daily, Vol. 177, No. 25, Monday, December 10, 1979, p.177)

**December 11.** Based on the recommendations received from the Marshall Space Flight Center, reviews of the performance of the HEAO-2 satellite, the mission was judged to be successful. Both the primary and secondary objectives, as stated in the Mission Operations Report of October 30, 1978, have



been accomplished. To date, more than 5,000 discrete observations have been performed with HEAO-2.

The performance of the HEAO-2 observatory has been excellent throughout the first 12 months of the mission. There have been two failures of redundant components, but these have had no effect on the mission. The failed components were a rate gyro that is part of a set of six interchangeable units (three are needed for observatory operation) and one of three star trackers (two are needed for normal operation).

All spacecraft systems are functioning well. The overall accuracy of the attitude determination system has been better by an order of magnitude than preflight conditions and is currently at 2 to 5 arc seconds.

The operation of the scientific instruments met or exceeded expectation. All of the instrument continued to operate normally, with the exception of the Solid State Spectrometer, which is no longer operating because of the depletion of its cryogenic refrigerator. This unit performed excellently for over 11 months, whereas its expect life prior to launch was estimated at about nine months. (Mission Operations Report, Post Launch Report, MOR NO. S-832-78-82, December 11, 1979)

- o NASA, which decided last year to develop a Thrust Augmentation System for the Space Shuttle, consisting of single solid rockets strapped to each Solid Rocket booster, has dropped the solid strap-on concept in favor of a Titan Liquid Boost Module (LBM).

The LBM is composed of two Air Force/Aerojet liquid-propellant engines developed for the Air Force/Martin Marietta Titan III launch vehicle, plus four Titan propellant tanks modified to fit beneath the Shuttle's External Tanks to provide the needed impulse.

A major factor in the decision is reportedly that the LBM will give the Shuttle a "softer ride" than the solid propellant motors would have. Other factors included the lower cost of the liquid system, its growth potential, Defense Department benefits and lower technical risks.

The Liquid Boost Module uses existing Titan engines and modified Titan Tankage and this requires little development money. The solid strap-on concept, on the other hand, would have required the development of new solid rocket motors at a cost of \$200 million to \$300 million.

Because DOD plans to retain a Titan launch vehicle capability as a backup to the Space Shuttle until the Shuttle is operational, unused engines from that program will be available for use on the LBM, further reducing the system cost. At the same time, the LBM program will retain Titan technology skills, which should help provide a lower risk more economical Shuttle backup program which DOD will need for critical payloads if the Shuttle is delayed.

First launch of the liquid augmentation package is planned for mid-1985, about the same schedule as planned for the solid system. Funds will be provided in FY '80 and FY '81 for advanced planning studies, with a new start to be requested in FY '82.

The \$15 million NASA requested in FY '80 for the Thrust Augmentation System was deleted from its appropriations bill, although the agency was given permission to shift money within its budget for work on the system.

The Thrust Augmentation System is required to make up a launch capability shortfall of about 8000 pounds for large polar orbit missions from Vandenberg AFB, brought about by the increased weight of the Shuttle Orbiter. (Defense/Space Business Daily, Vol. 107, No. 26, Tuesday, December 11, 1979, pp.179,180)

- o NASA, which has apparently won its battle with the Office of Management & Budget over whether to initiate development of the Solar Electric Propulsion Stage in FY '81, December 11 announced the selection of Boeing Aerospace Co. (Seattle) and Lockheed Missiles & Space Co. (Sunnyvale, Calif.) for 12-month parallel design definition studies of the SEPS.

The two companies were selected for the \$1.15 million contracts over Hughes Aircraft Co. (El Segundo, Calif.) and Rockwell International Corp. (Downey, Calif.).

The design contracts will pave the way for award of the SEPS development contract a year from now. NASA's Marshall Space Flight Center has been named to manage the SEPS program for the agency.

Early go ahead for the SEPS is critical to the proposed Halley's Comet/Tempel II Comet mission in 1985, which is dependent upon the sustained thrust to be provided by the solar-electric engines.

NASA emphasized, however, that SEPS will be "an integral part" of its Space Transportation System, with uses foreseen for Earth orbital, planetary and solar missions.

NASA is expected to seek the Halley's/Tempel II mission as a new start in FY '82. It began soliciting proposals for experiments to be carried on the yet-to-be-approved mission last month. (Business Daily, Vol. 127, No. 28, Thursday, December 13, 1979, p.195)

**December 16.** A five-day test to check the compatibility of all systems aboard the Space Shuttle's Orbiter with ground and launch support equipment began at 4 p.m. Sunday.

NASA officials said the test would be conducted around the clock using various astronaut crews, including John Young and Bob Crippen, prime crew for the first shuttle mission, who will operate the Orbiter.

They will alternate with members of the backup crew, Air Force Col. Joe Engle and Navy Cmdr. Richard Truly.

Young is the only one who has been in space. He flew in two Gemini missions and two Apollo missions, including landing on the moon as commander of Apollo 16.

The Orbiter spaceship will be tested by simulating various launch conditions, on-orbit activity and landing procedures.

The simulation will include emergencies and various possible problems as well as normal missions. It will run 24 hours a day for the 140 hours.

Test results are expected to be known by the end of the week. (Today, Today Newspaper, Cocoa, Florida, Monday, December 17, 1979.)

**December 17.** The Space Shuttle program moved a major step forward when engineers at Bay St. Louis Miss., successfully conducted a 550-second full duration static test firing of the three-engine Space Shuttle Main Propulsion Test Article. Testing had been in abeyance since a test failure Nov. 4 which damaged one engine. NASA reported that all test goals were achieved in the test, where the three engines were fired at rated power of 100 percent, 90 percent, 80 percent, and then 70 percent. One engine was cut off during the test as planned. There were no gimballing or pogo problems. (Defense/Space Business Daily, Vol. 107, No. 31, Tuesday, December 18, 1979, p.221)

**December 20.** After several days of delay, NASA Thursday successfully conducted the first of five simulated Space Shuttle launches and flight. NASA termed the all systems simulation "super successful" and was hoping to make a second test Friday.

The prime crew for the first Space Shuttle launch, astronauts John Young and Robert Crippen were at the controls of the Orbiter Columbia for the 46-minute test. The vehicle is in the Orbiter Processing Facility at KSC, resting on its landing gear.

Objectives of the planned 140-hour Orbiter Integration Test series included the demonstration of selected Orbiter hardware and software subsystem operations during a mission timeline. The test was also designed to demonstrate the ability to switch from the primary to backup flight control system, the ability of ground support systems to support an Orbiter countdown and the capability of the interface between the Orbiter onboard software to the Mission Control Center. Upcoming launch simulations will include emergency and abort contingencies. (Defense/Space Business Daily, Vol. 107, No. 35, Wednesday, December 26, 1979, pp.244, 245.)

- o The space shuttle Columbia "lifted off" on its simulated flight Thursday night, with veteran astronauts John Young and Navy Cmdr. Robert Crippen in the cockpit.

The Columbia began a 45-minute test designed to duplicate, by computer, everything that would happen on a real blastoff.

The test with Young and Crippen had been scheduled for Tuesday, and was to have been the second of five days of tests. But the mock flight was delayed several times by problems with the computer programs designed to run the tests.

The latest delay came earlier Thursday, when another balky computer malfunctioned. A scheduled 10:45 "liftoff" was postponed to 9 p.m.

A space center spokesman said the liftoff went flawlessly, and the shuttle performed well 14 minutes into the simulated flight. (UPI, Sentinel Star, Orlando, Florida, Friday, December 21, 1979.)

**December 27.** The Geodynamics Experimental Ocean Satellite (GEOS-3) was launched on April 9, 1975. On July 1, 1979, operation of the GEOS-3 alti-

meter, the primary experiment instrumentation, was terminated. Functional use of GEOS-3 for calibration of DOD C-band ground radar tracking systems is expected to continue on a cost-reimbursable basis through February 1980. The decision to terminate GEOS-3 altimetric observations was based on serious degradation of the high intensity mode which occurred in late 1978. This mode, which was used almost exclusively during the mission, provides a spatial resolution of 3.6km. Operations were continued in 1979 using the global mode (14.3km resolution) to complete joint NOAA and Navy sea-state and ice-boundary monitoring investigations. While all other GEOS-3 systems are performing satisfactorily, the resolution available with the global mode has limited application and continued data acquisition is not warranted.

Final processing of the GEOS-3 mission data (launch through October 31, 1978) is to be completed in December 1979. The intensive mode altimeter dataset will be archived by the NOAA Environmental Data and Information Service (EDIS) similarly to the handling of Seasat-1 data. The GEOS-3 altimeter data will be referenced to precise satellite orbits determined using laser tracking data, augmented with STDN radar and DOD Doppler data. The GEOS-3 data set will be archived in two forms; one consisting of about 12 magnetic tapes giving smooth sea surface heights which will be useful primarily for geodetic analysis, and a second more extensive format consisting of about 145 magnetic tapes which will be useful for either geodetic or oceanographic analysis.

During the 3-1/2 years of normal operations, the GEOS-3 altimeter provided the most complete set of geodetic and geophysical data ever collected over the oceans, more than from all the previous years of ship measurements. The DOD has stated that these data have resulted in an estimated accumulated savings of \$140 million in ship gravity survey operations over the next 10 years.

In each of the 13 areas of investigation, the GEOS-3 data have been successfully used to further scientific knowledge and to demonstrate practical applications of remotely sensed data. All of the mission objectives were satisfactorily achieved during the first year of operations and were so certified on Page 4 of Post Launch Report #2, dated February 25, 1976.

GEOS-3 contributions to the understanding and application of microwave altimetry as a source of ocean, ice, and land surface topography measurements and as a means of sensing a variety of oceanic parameters, have been invaluable. Its primary instrument was the first altimeter extensively operated in space with all capabilities fully demonstrated and applied, and has paved the way for future operational radar altimeter satellites. (Mission Operations Report, Post Launch Report No. 3, MORE No. E-855-75-01, December 27, 1979.)

- o During December: To increase Space Shuttle performance from the Western Test Range, NASA has decided to adopt, as a baseline, the Liquid Boost Module (LEM) concept for Space Shuttle Thrust Augmentation.

This concept employs the existing Titan first stage core engines and tankage, modified as required, to be mounted under the external tank. Thrust Augmentation will increase Space Shuttle performance for missions from WTR by 12,000 to 36,000 pounds, allowing NASA Spacelab flights from there, as well as providing substantial growth capability for other Department of Defense and NASA flights.

Another plan studied by NASA proposed attaching strap-on rocket motors to the Shuttle's solid rocket boosters. While total development and integration costs were assessed by NASA as being comparable for the liquid and solid concepts, the LBM offers a greater increase in capability from the baseline case. This results in a lower unit cost per flight in terms of dollars per pound of additional payload.

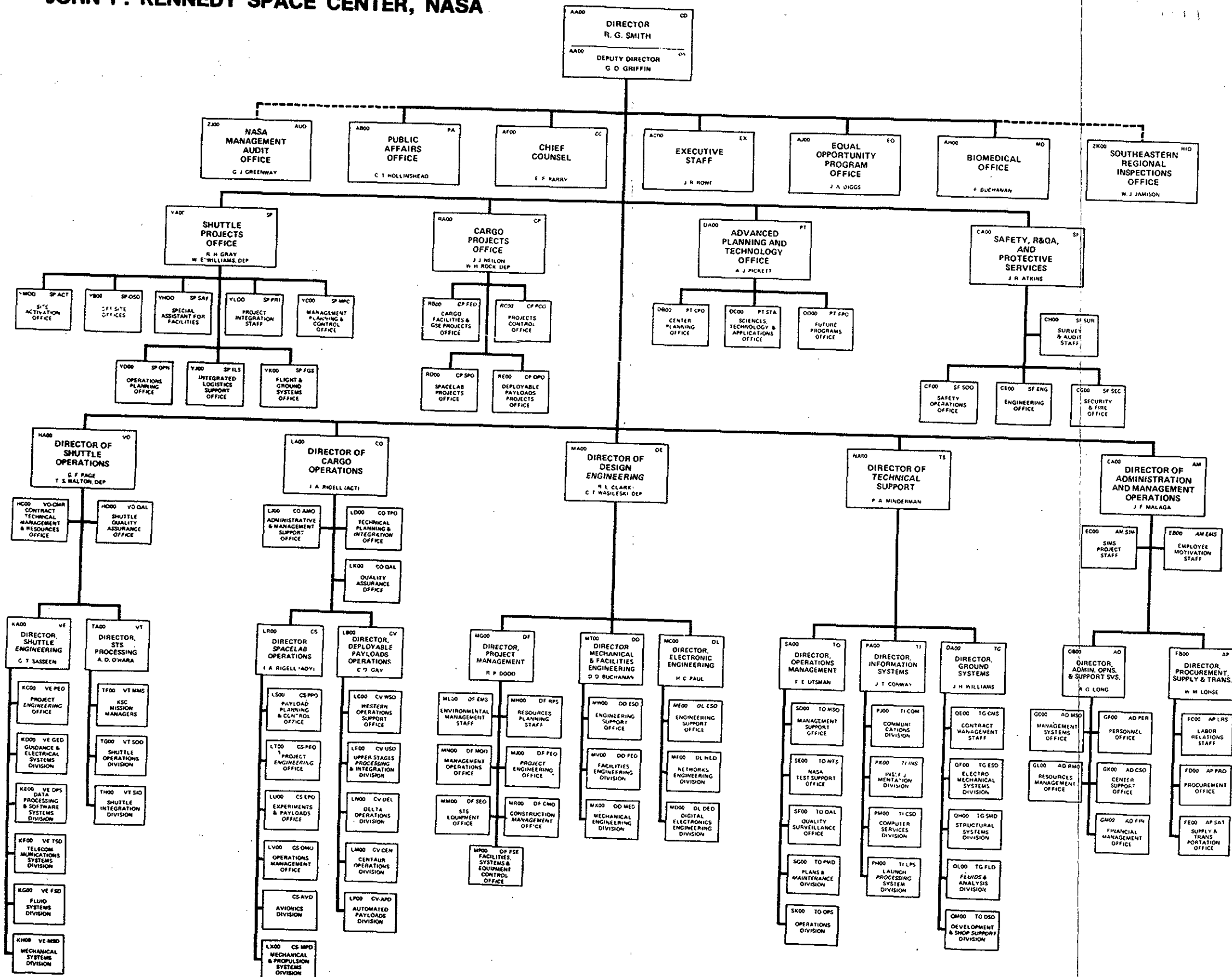
NASA's present target date for availability of the Thrust Augmentation at WTR is mid-calendar year 1985. Authorization to proceed at the beginning of FY 1982 would support the mid-1985 availability date.

During FY 1980 and FY 1981, NASA will generate design specifications and determine system impacts for the Liquid Booster Module. (Spaceport News, Vol. 18, No. 27, John F. Kennedy Space Center, December 7, 1979)

APPENDIX A  
KSC ORGANIZATION CHART  
OCTOBER 1979

00000399

# JOHN F. KENNEDY SPACE CENTER, NASA



00000400



APPENDIX B  
MAJOR NASA LAUNCHES  
JANUARY THROUGH DECEMBER  
1979

00000401

# APPENDIX B

## MAJOR NASA LAUNCHES JANUARY 1 - DECEMBER 31, 1979

<u>DESIGNATION</u>	<u>DATE</u>	<u>LAUNCH VEHICLE</u>	<u>SPACECRAFT</u>	<u>LAUNCH PAD</u>	<u>ETR TEST NO.</u>	<u>RESULTS</u>
SCATHA	01-30-79	DELTA 148	SCATHA	17B	7802	S
FLTSATCOM 2	05-04-79	ATLAS-CENTAUR 47	FLTSATCOM-B	36A	25I3	S
WESTAR 3	08-09-79	DELTA 149	WESTAR-C	17A	2292	S
HEAO 3	09-20-79	ATLAS-CENTAUR 53	HEAO-C	36B	8310	S
RCA-SATCOM 3	12-06-79	DELTA 150	RCA-SATCOM-C	17A	4555	P

00000402